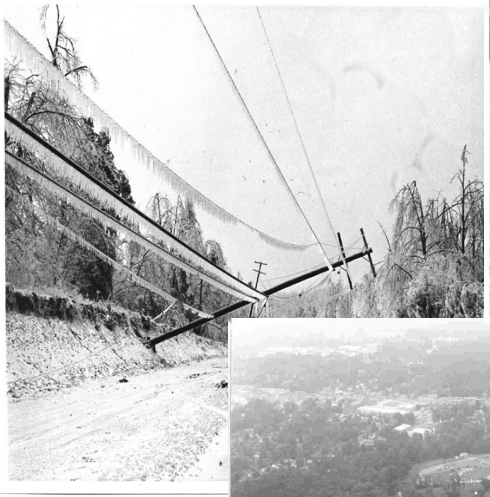
Hamilton County, Tennessee
Natural Hazards Mitigation Plan



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Chapter 1 – Introduction and Background

Purpose

This plan seeks to develop a comprehensive strategy to reduce the impacts of natural hazards in Hamilton County. The rising costs and apparent increase in the rate of occurrence of natural disasters has led to the need to identify additional ways to reduce the County's vulnerability to natural hazards—before the next disaster actually occurs.

Disasters can exact a heavy toll. In the past, natural hazards in Hamilton County have caused injury and loss of life, severe property damage, interruption of the delivery of vital goods and services, disruption of local economies, and harm to the natural environment. Natural hazards are an inevitable fact. Human ingenuity can do nothing to stop a tornado or winter storm from occurring. Planning for natural hazards and implementing mitigation measures, however, can reduce the impact of such events when they do occur. Monetary losses, personal injury, loss of life, as well as economic, social, and environmental impact on the community can be reduced. The purpose of this plan, therefore, is to outline a strategy with specific programs and policies that can be implemented by Hamilton County and local units of government within Hamilton County to reduce the impact of natural hazards on people, structures, and the natural environment. Chattanooga, Collegedale, East Ridge, Lookout Mountain, Hamilton County, Red Bank, Signal Mountain, Soddy-Daisy, and Walden are continuing plan participants. The University of Tennessee at Chattanooga (UTC), and the Hamilton County Department of Education (HCDE) are new plan participants. The City of Lakesite participated in the original plan development but decided not to participate in this update. Lakesite understands that they have the opportunity to participate in future updates if they choose.

Background

Hamilton County is the fourth largest County in Tennessee with 2010 population of 336,463. The City of Chattanooga is the fourth largest city in the state with a 2010 population of 167,674. Principal towns, in addition to Chattanooga, are Red Bank, Soddy-Daisy, Collegedale, East Ridge, Lookout Mountain, Walden, Ridgeside, Lakesite, and Signal Mountain (Map 1).

Hamilton County is located in southeastern Tennessee and is bordered on the north by Rhea and Meigs counties, Tennessee; on the east by Bradley County, Tennessee; on the west by Bledsoe, Marion, and Sequatchie Counties, Tennessee; and on the south by Dade, Walker, and Catoosa Counties, Georgia. The major city in the county is Chattanooga, which serves as a major trade and industrial center in the southeast.

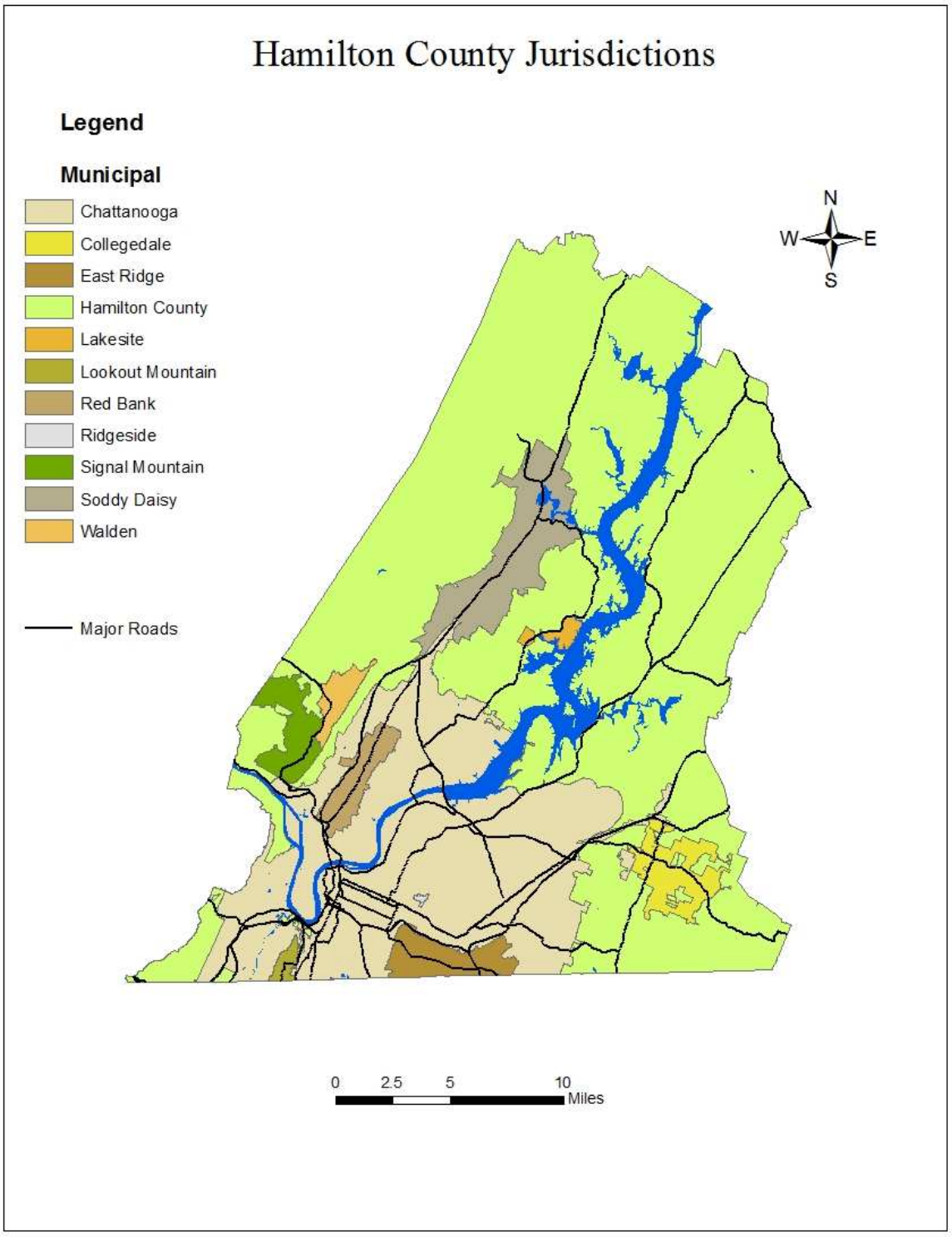
The county covers approximately 575 square miles or 368,479 acres. Hamilton County is divided from north to south by the Tennessee River and the Chickamauga and Nickajack Reservoirs.

Hamilton County includes two distinct geographic areas, the Cumberland Plateau and Mountains and the Southern Appalachian Ridges and Valleys. In winter, valleys in Hamilton County are very cool with occasional cold and warm spells. Upper slopes and Mountaintops

are generally cold. In summer, the valleys are very warm and frequently hot, and mountains that are warm during the day become cool at night. Precipitation is heavy and evenly distributed throughout the year. Summer precipitation falls mainly as thunderstorms.

Major transportation corridors include Interstates 24 and 75; U.S. Routes 11, 27, 41, 54, 72, and 127; State Routes 27, 29, and 58; and the CSX and Norfolk Southern Railway.
Colleges and universities in Hamilton County include the University of Tennessee at Chattanooga, Chattanooga State Technical Community College, Southern Adventist University, and Tennessee Temple University.

Map 1



History

Hamilton County

As early as 200 BC the Cherokee nation inhabited the area around Lookout Mountain and the Chattanooga Valley and called it Chatanuga, or "rock rising to a point." Creek, Choctaw, and Shawnee tribes also inhabited the land, but the overwhelming majority of the population was the Cherokee people.

The Tennessee General Assembly created Hamilton County on October 25, 1819. Rhea, Marion, and Bledsoe Counties bounded the new county, and it extended south to the state line. The creation of the new county on the southwestern frontier was brought about by a treaty with the Cherokees in 1817. By the terms of the Hiwassee Purchase, the Indians yielded large sections of Alabama and Georgia, as well as the Sequatchie Valley and the area that became Hamilton County. Initially, Hamilton County did not extend south of the Tennessee River. This area, including the site of Cherokee Chief John Ross's landing in present-day Chattanooga, did not become a part of the county until the disputed Treaty of 1835 that led to Indian removal and the "Trail of Tears." The county was named in honor of Alexander Hamilton, secretary of the treasury in George Washington's administration. Hamilton was the name of the district of which this section had formerly been a part.

At the time of the 1820 census, Hamilton County counted 821 residents, including 16 free blacks and 39 slaves. Approximately 100 Cherokees lived on six private family reserves. The settlers were clustered mainly at Sale Creek, at Poe's Crossroads (Daisy) and at the farm of Asahel Rawlings (Dallas). The courts were later moved nearby to the farm of John Mitchell before a log courthouse was built at Dallas on the Tennessee River. The county seat was shifted across the river to the new town of Harrison in 1840. Chattanooga, whose growth far outstripped that of Harrison, became the seat of government in 1870.

Chattanooga

Chattanooga's future as a railroad center was assured when the Western and Atlantic Railroad selected it as its northern terminus. This line reached the city in 1849, and the Nashville and Chattanooga Railroad was completed in 1854. The East Tennessee, Virginia and Georgia Railroad, the Cincinnati Southern, and other rail lines later were extended to the growing city.

A rail center and the "Gateway to the South," Chattanooga became a focal point in the Civil War, especially in the summer and fall of 1863. The Army of Tennessee under General Braxton Bragg fell back from the city and fought a bloody battle at nearby Chickamauga, Georgia, on September 19 and 20, 1863. From the surrounding mountains, the Confederate forces besieged Chattanooga until the arrival of Union forces under General Ulysses S. Grant and General William T. Sherman. The Union won victories at Wauhatchie and Lookout Mountain prior to the famous charge up Missionary Ridge on November 25, 1863.

After the Civil War, Chattanooga experienced a cholera epidemic in 1873 and a yellow fever scourge five years later. There were also devastating floods in 1867 and 1886. The city still managed to develop as a manufacturing center and underwent a real estate boom in the late

1880s. Later, it became the site of the first Coca-Cola bottling franchise and the headquarters for several major insurance companies. The Krystal hamburger, the Moon Pie, and the Double-Cola soft drink originated and have their corporate headquarters in Chattanooga.

A recent focus has been development of the downtown riverfront, including erection of the Tennessee Aquarium, the Children's Discovery Museum, the IMAX Theater, and the Chattanooga Visitors Center. The Walnut Street Bridge was restored as a popular pedestrian walkway, and the Tennessee Riverwalk was built along the river. Chattanooga, which had a remarkable cleanup of its polluted air, is developing a reputation as "the environmental city," featuring electric buses, greenways, and an expanded convention center with an environmental design.

Collegedale

Collegedale was incorporated in 1968. The name was derived from the presence of Southern College, which has now gained University status. O.D McKee, founder of McKee Foods, which produces Little Debbie Snack Foods, is one of the areas prominent residents. McKee Foods is the areas largest employer.

East Ridge

The Town of East Ridge was incorporated under Private Acts 1921, Chapter 569 on January 12, 1954. The citizens of the town voted to become a home rule municipality on November 3, 1970. Voters elected to change the name from the Town of East Ridge to the City of East Ridge. East Ridge was named for the area “East of Missionary Ridge,” the site of a major Civil War Battle.

Lookout Mountain

Lookout Mountain was the site of the Civil War “Battle above the Clouds” on November 25, 1863. A National Military Park was dedicated to commemorate the event in 1934. Lookout Mountain was incorporated as a town in 1890. The Incline Railway (1896) and National Military Park make Lookout Mountain a popular tourist destination.

Redbank

Red Bank began as an early rural suburb of Chattanooga running along the Dayton Pike from Stringer's Ridge to Daisy, TN. Its growth began by a housing boom following World War I. Early settlements sprang up along the stops of the Chattanooga Traction Company trolley line. By 1945, the population in the area of Red Bank had grown to over 4,000 and thoughts of becoming a new city began to arise as an option that was seriously being considered by many of its residents. Red Bank-White Oak was chartered in 1955. On January 7, 1967, the city of Red Bank-White Oak officially became Red Bank.

Signal Mountain

During the Civil War Battle of Chattanooga in the fall of 1863, the Union Army used Signal Point as a communications station to signal various locations in the Chattanooga area.

Development of the area began in 1878 when Charles E. James bought 4,400 acres of land in the signal point area. He constructed a streetcar track up the mountain and built Signal Mountain Inn, which opened in 1913. By 1925, two hundred houses had been built within a few blocks of the Inn. The Town of Signal Mountain received its charter from the State of Tennessee on April 4, 1919. The town's charter was changed in 1990 to convert to a Council/manager form of government.

Soddy-Daisy

William Sodder established a trading post at Soddy around 1770. This post spawned an enclave in the wilderness in which continental soldiers settled in 1789. Perhaps the biggest boon to development in the area was the discovery of coal in the ridges.

For years, mining was the primary economic activity in the northern part of Hamilton County. In 1867, the Soddy Coal Company began operation. With the establishment of the mining industry, the town of Soddy began to grow. The majority of housing and business in the developing town was company-owned.

The Daisy Community was also involved in mining operations, but on a somewhat smaller scale. While both Soddy and Daisy were successful coal mining communities, the decline and eventual closing of the mines in the 1930's forced businesses to close and some people to move elsewhere in search of employment. To make things worse for Soddy was the 1947 construction of US 27, which by-passed the business district of the town. However, the road went through the Daisy Community. Because of the highway, a hosiery mill, and a turpentine plant Daisy held onto some of its population. In April of 1969, the communities of Soddy and Daisy incorporated to form the city of Soddy-Daisy. Since then, several occurrences have shaped the physical character of the City. Among these are the construction of US 27 / State 29, which bisects the city east, and west. The Sequoyah Nuclear Power Plant has spawned development in the eastern portion of the City.

Walden

Walden received its Charter from the State of Tennessee on August 11, 1975 with an initial population of 1,118 residents. Walden is located on Walden's ridge at an altitude of approximately 2,080 feet. It is primarily a rural residential area with several small businesses and churches.

University of Tennessee at Chattanooga (UTC)

Located near downtown Chattanooga, UTC had been a private institution for 83 years when it joined the University of Tennessee's system of statewide campuses in 1969. Total enrollment in 2010 was 10,781 with 2,957 students residing in campus housing. The UTC physical plant consists of 77 buildings with approximately 2,407,655 gross square feet.

Hamilton County Department of Education

The Hamilton County Department of Education (HCDE) is the fifth largest school system in the state of Tennessee, covering the county's entire geographical area. The district boasts 78

different schools comprised of 46 elementary schools, 21 middle schools, 17 high schools, 14 magnet schools, an alternative program, a program for special needs students, and an adult high school. The system counts more than 42,000 students, and 6,500 employees. Hamilton County Schools has 34 Title I schools that receive federal funds to help raise student achievement in schools with high rates of poverty.

Hamilton County Schools serves a diverse student population with the following ethnic make-up: 61% White, 33% African American, 4.1% Hispanic, 1.8% Asian and .2% Native American. Hamilton County Schools serves roughly 6,000 students with disabilities and an additional 4,000 who quality for gifted and talented programs. Hamilton County has roughly 900 students who qualify for English as a Second or Other Language programs.

Natural Hazard Overview

A review of past natural disasters in Hamilton County, and across the State of Tennessee highlights thirteen hazards as presenting a significant potential risk to the communities of Hamilton County. These hazards include flood, winter storms, thunderstorms and associated hail, lightning, tornado, and high wind, as well as landslide and erosion, earthquake, drought, and wildfire.

The most costly natural hazard in Hamilton County is flooding. Since 1936, TVA regulation of the Tennessee River has substantially reduced the frequency and magnitude of Tennessee River floods and backwater flooding of local tributaries. However, flooding remains a serious concern. Since 1993, the National Climatic Data Center (NCDC) has documented 35 flood events in Hamilton County producing an annual average of 6.8 million dollars of property damage. A major flood event in March of 1994 was the areas worst flood since 1973 and caused approximately 50 million dollars in property damage.

Thunderstorms and related hail, lightning, and high winds are the most frequent natural hazard to affect Hamilton County. Since 1950, The NCDC has documented 448 significant thunderstorm related weather events causing an average of $106,000 in annual property damage. Tornadoes are a less frequent natural hazard associated with thunderstorms, but a far more devastating and costly one. The National Weather Service Forecast Office in Morristown, Tennessee provided documentation of 16 tornadoes that have affected the County since 1883. The most recent major tornado event occurred on April 27, 2011 with ten documented tornados raging through the county. The most serious was an EF-4 that ravaged the Apison area in the southeast portion of the county killing 8 residents and causing massive property damage.

Although infrequent, winter storms, particularly ice storms, are a serious hazard. Damage associated with winter weather events occurs mainly as traffic accidents, downed utility lines, and fallen trees. The Ice Storm of March 1960 caused approximately 30 million dollars of property damage and shut down the towns of Walden, Signal Mountain, and Lookout Mountain for up to seven days. The “Blizzard of March 1993” dropped up to 3 feet of snow in the upper elevations and caused approximately fifty thousand dollars in property damage.

The many hillsides and steep slopes in Hamilton County present areas potentially susceptible to landslide and erosion. Past landslide events have been associated with heavy rain,

denuding slopes of vegetation or roadway construction. Area stream banks are also susceptible to severe erosion following heavy rains.

Historic records for earthquake events are very limited in comparison to the geologic time scale. Hamilton County is in the East Tennessee Seismic Zone, the second most active seismic zone east of the Rocky Mountains. On April 29, 2003 a 4.9 magnitude earthquake with an epicenter located in Fort Payne, Alabama was felt in Hamilton County. There is a small but potentially serious risk from earthquake events.

Finally, the impacts of drought are considered because of the potential for wildfire in the forested areas of Hamilton County and impacts on agriculture. Forested steep slopes and bluff lines are particularly vulnerable to wildfire because of the difficulty of controlling once ignited.

What is Hazard Mitigation?

Mitigation refers to the policies and activities that will reduce the area's vulnerability to damage from future disasters. Generally, these measures are ones that can be put in place before a disaster occurs. There are a multitude of different types of mitigation programs that can be put in place. In general, mitigation activities can be broken into two categories, structural and non-structural.

> *Structural mitigation* measures try to minimize the effect of hazards on people, buildings, and infrastructure. This includes actions such as building dams and levees, flood-proofing homes, constructing tornado shelters, and instituting building codes that require wind resistant construction.
>
> *Non-structural mitigation* measures typically concentrate on identifying hazard-prone areas and limiting their use. Examples include land use zoning, the selection of building sites, tax incentives, insurance programs, relocation of residents to remove them from the path of a hazard, the establishment of warning systems, and planning for at-risk populations.

Plan Requirements

This plan is designed to meet the requirements of the Federal Disaster Mitigation Act of 2000 (DMA 2000). The DMA 2000 established new hazard mitigation project funding mechanisms and new state and local planning requirements as conditions of project funding eligibility. The DMA 2000 also provides specific criteria for the preparation and adoption of multi-jurisdictional, "all-hazards" mitigation plans by local governments to meet these requirements. The Hamilton County Natural Hazard Mitigation Plan was prepared to support the requirements of a mitigation plan for all participating local governments in the County. DMA requirements specify that the following elements must be included in the plan:

- Adoption by the local governing body. The plan must include documentation that the local governing body has formally adopted the plan. In a multi-jurisdictional plan, all participating local units of government seeking plan approval must individually adopt the plan.

- All local units of government included in the plan must participate in the planning process.
- The plan must document how the plan was prepared and who was involved in the planning process. Public involvement is essential.
- A risk assessment section should include:
    - Identification of the hazards likely to affect the area, noting data limitations and providing an explanation for eliminating hazards from further consideration.
    - A discussion of past events and description of their severity and resulting effects.
    - A description of the local vulnerability to the described hazards in terms of the types and numbers of buildings, infrastructure, and critical facilities located in the potentially affected areas.
    - A description of the potential dollar losses to the vulnerable structures identified and a description of the methods used to calculate the estimate.
    - A description of the vulnerability in terms of land use and development so that mitigation options can be considered in future land-use decisions.

- The plan must include a hazard mitigation strategy describing:
    - Goals to reduce or avoid long-term vulnerabilities to the identified hazards.
    - A range of specific mitigation actions and projects to be considered, with particular emphasis on new and existing buildings and infrastructure.
    - An action plan identifying how the actions will be prioritized, implemented, and administered by the local jurisdiction. Prioritization must include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
    - For multi-jurisdictional plans, there must be identifiable actions items specific to the jurisdiction requesting FEMA approval of the plan.
    - Provisions for reviewing, monitoring, and evaluating progress of the plan's implementation. The plan must also be updated at least every five years and re-approved.

FEMA Hazard Mitigation Project Funding

After November 1, 2004 cities, towns, and counties not having a FEMA approved hazard mitigation plan will be ineligible for certain types of disaster assistance. Under the terms of the DMA, local governments affected by a federally declared disaster are still eligible for emergency aid without having a plan in place. However, those local units would be ineligible for FEMA funds to support hazard mitigation projects that are a part of the normal rebuilding and recovery process.

In addition to post-disaster mitigation funding, local preparation and FEMA approval of a mitigation plan provides participants the opportunity to apply for FEMA administered pre-disaster mitigation project funding. This is a competitive, national grant program designed to reduce over-all risks to the population and structures, as well as reducing the future reliance on federal funding for recovery after a disaster.

In addition to simply identifying and describing natural hazards, the plan also analyzes vulnerability to each hazard. The vulnerability assessment describes not only the physical

characteristics of each hazard, but also the potential impact of each hazard on people, buildings, and the social and economic infrastructure of the communities of the County.

Using the vulnerability assessment as the basis for planning, and with the involvement of local units of government, Hamilton County has prepared this multi-jurisdictional natural hazard mitigation plan. The plan identifies goals, information, and measures for hazard mitigation and risk reduction to make communities more disaster resistant and sustainable. In addition, mitigation actions can protect critical community facilities, reduce exposure to liability, and minimize community disruption. Information in the plan can also be used to help guide and coordinate mitigation activities and local policy decisions for future land use decisions within communities.

Chapter 2- Natural Hazards Mitigation Planning Process

Planning Process

In June of 2009, the Hamilton County Mitigation Planning Group members were notified of the pending update of the Mitigation Plan. Hamilton County Emergency Management met with representatives of each participating jurisdiction to review the update process and requirements. Each member of the planning group was provided a copy of *Local Multi-Hazard Mitigation Planning Guidance,* the *Local Mitigation Plan Review Crosswalk,* and *Mitigation Ideas: Possible Mitigation Measures by Hazard Type*. Greg Helms, Lead Emergency Management Planner for Hamilton County, led the development of the of the plan update.

The major focus of the plan update is concentrated on Chapters 2 *Planning Process,* Chapter 3 *Hazard Analysis,* and Chapter 4 *Mitigation Strategy, Actions, and Implementation.* Minor revisions were recorded in Chapter 1 *Introduction and Background* in the Natural Hazard Overview section to reflect results of the updated Hazard Analysis. The planning group also recommended minor revisions to Chapter 5 *Monitoring, Evaluation, Updating the Plan, and Public Involvement* to reflect the ongoing project to update area flood maps, as well as new ways to engage the public in future plan updates.

The Mitigation Planning Group with support from a Mitigation Planning Support Group followed a mitigation planning process developed from materials provided by the Federal Emergency Management Agency (FEMA). This process involved the following steps:

1. Review and confirm consensus on potential hazards

   All participants reviewed Chapter 3 Hazard Analysis to determine whether new hazards should be considered or previously identified hazards should be removed from the plan. A consensus emerged from the review that fog should be removed from the chapter due to existing mitigation actions and the very low impact of the hazard.

2. Update information concerning each hazard

   All participants provided information specific to their jurisdiction to Emergency Management. Emergency Management incorporated the new information provided by plan participants as well as information provided by the planning support group to update the hazard analysis in Chapter 3.

3. Review and update prioritization of hazards

   All participants reviewed hazard prioritization. Due to the recent rise in tornadic activity, the planning group placed a higher priority on mitigation actions related to tornados. Two new plan participants, the University of Tennessee at Chattanooga and the Hamilton County Department of Education, identified tornados as their primary concern. It was agreed that flooding, severe storms, and tornados are the top priority hazards countywide.

4. Review plan goals and objectives

All participants reviewed the problem statements and goals in Chapter 2. It was agreed to update this section to reflect the increasing frequency of severe storms and tornados, as well as the potential for extreme flood events.

5. Update the status of current mitigation actions. Develop and prioritize new mitigation actions as needed.

All participants reviewed Chapter 4 and updated the status of mitigation actions specific to their jurisdiction. Mitigation actions were identified as completed, ongoing, deferred, or eliminated. New mitigation actions were prioritized and included in the plan update.

Participants also reviewed the implementation strategies in Chapter 4 and provided recommendations to strengthen implementation of the plan.

6. Prepare draft update of the Mitigation Plan

Hamilton County Emergency Management prepared the written draft plan.

8. Review the draft plan within the Planning Group

All participants reviewed the draft plan before submittal to the state for review.

9. Provide the opportunity for the public and other local groups to review the draft and provide comment

Hamilton County Emergency Management posted public notice in the Chattanooga Times Free Press legal announcements. The public was provided the opportunity to comment in response to the legal announcement or through a notice and posting of the draft plan on the county emergency Management website. Each jurisdiction may also provide a separate public notice and provide the opportunity for public comment through its website and legislative meetings.

10. Submit plan to the State of Tennessee

Hamilton County Emergency Management submitted the draft update to the State Mitigation Office for review.

11. Revise the plan based on State recommendations in preparation for review by FEMA.

Hamilton County Emergency Management revised the plan based on State recommendations and participants reviewed and approved the revised plan for final submittal. If applicable, Emergency Management will incorporate FEMA recommendations and resubmit the final draft.

12. Present the approved plan to the public for final comment

Hamilton County Emergency Management will post public notice of the final updated plan and provide the opportunity of the public to review and comment prior to adoption.

13. Adopt the plan

Each jurisdiction or participant in the plan will be required to formally adopt the plan to maintain edibility for certain hazard mitigation grant programs.

The following tables list the Mitigation Planning Group participants as well as the Mitigation Planning Support Group members.

Hamilton County Natural Hazard Mitigation Planning Group Participants		
Bill Tittle	Chief of Emergency Management	Hamilton County Emergency Services
Greg Helms	Lead Planner Emergency Management	Hamilton County Emergency Services
Trish Startup	Grants Coordinator	City of East Ridge
William Whitson	City Manager	City of East Ridge
Terrie Robertson	Building and Codes	City of East Ridge
Christopher Dorsey	City Manager	City of Redbank
Wayne Hamill	Public Works	City of Redbank
Chief John Vlasis	Fire Chief	Town of Signal Mtn.
Loretta Hopper	Engineer Tech	Town of Signal Mtn.
Randall Bowden	Chief of Fire and Police	Town of Lookout Mtn.
Ansley Moses	City Manager	Town of Lookout Mtn.
Bobby McDaniel	Superintendent of Public Works	Town of Lookout Mtn.
Rick Dockery	Superintendent of Parks	Town of Lookout Mtn.
Hardie Stulce	Public Works Director	City of Soddy Daisy
Steve Grant	Public Works	City of Soddy Daisy
Peter Hetzler	Mayor	Town of Walden
Andrew Morkert	Public Works	City of Collegedale
Richard Hutsell	Zoning Inspector/CFM	City of Chattanooga
Allen Welton	Building Inspector	City of Chattanooga
John Agan	Engineering Project Manger	Hamilton County
Harold Austin	Director Highway Department	Hamilton County
Pat Payne	Director Building Inspection	Hamilton County
Tim Pridemore	Emergency Management Specialist	UTC
Gary Waters	Assistant Superintendent	HCDE
Tim Harper	Safety Manager	HCDE

Mitigation Planning Support Group	
	Role
TVA	Flood Maps and data ; dam safety, flood modeling
Regional Planning Agency	Public Information, Development and Demographic Data and Analysis
Hamilton County GIS	Geographic Data, Analysis, and Maps
Electric Power Board	Vulnerability Analysis/Damage Assessment
Chattanooga-Hamilton County Health Department	Coordinate review of Hazard identification and Vulnerability assessment with local hospital emergency preparedness coordinators
Chattanooga-Hamilton County Stormwater Management	Identify local non flood zone areas subject to flash flooding
National Weather Service Morristown	Provide historical weather data, significant event cost data
USGS	Flood prediction for Southern Hamilton County. Advised on additional stream gauges

Neighboring Communities, Commercial, Academic, and Nonprofit outreach

A notification letter was sent to adjoining counties stating that Hamilton County had begun the process of preparing a Natural Hazards Mitigation Plan. The letter invited the participation of interested parties. A copy of the letter and list of recipients is included in the appendix.

Hamilton County Emergency Management maintains an extensive network of contacts within the community. In an ongoing effort to raise awareness of the benefits of mitigation planning and to increase community involvement, Emergency Management strives maintain community awareness of mitigation planning activities within Hamilton County. As a result of this outreach, The University of Tennessee at Chattanooga and the Hamilton County Department of Education have formally joined the planning group.

A specific area of community interest is in Continuity of Operations (COOP) planning. Emergency management has conducted numerous COOP workshops and presentations for local nonprofits and businesses. Vulnerability analysis and mitigation play a significant role in COOP planning and these workshops are a valuable venue for raising awareness of our local mitigation planning efforts.

Problem Statements and Goals

The community hazard survey, conducted for the 2005 plan, as well as problem statements, and planning goals were revisited and updated by the planning group to reflect new information or changes in priorities. The only recommended change was the removal of fog as a hazard. The area continues to experience periodic episodes of heavy fog, but local advisories, road reflectors, and driver awareness were deemed adequate to deal with problem.

Hamilton County, Tennessee Natural Hazard Risk Assessment Matrix

	Unincorporated County	Chattanooga	East Ridge	Red Bank	Soddy-Daisy	Collegedale	Signal Mountain	Lookout Mountain	Walden	HCDE	UTC	Hazard Score
100 Year Floodplain	3	3	3	3	3	3	0	0	0	2	3	23
Flash Flood	3	3	3	2	3	3	1	0	1	1	1	21
Non flood zone flood	2	3	3	1	1	3	0	0	0	1	3	17
Ice storm	2	3	2	2	3	3	3	3	2	2	3	28
High wind	2	3	3	2	2	2	3	2	2	2	3	26
Winter Storm	2	2	2	2	3	2	2	3	2	2	2	24
Stream Bank Erosion	3	3	3	3	3	3	1	0	0	0	2	21
Thunderstorm	2	2	3	0	3	2	2	1	1	2	2	20
Lightning	1	3	3	2	1	1	2	2	1	1	3	20
Tornado	3	3	3	3	3	3	3	3	3	3	3	33
Wildfire	2	0	2	2	1	1	1	3	1	1	0	14
Landslide	1	1	1	0	2	3	3	0	1	1	0	13
Hail	1	1	1	2	1	2	1	1	1	1	1	13
Earthquake	1	1	1	2	1	1	1	1	1	1	1	12
High/Low Temperature	1	1	1	1	1	1	1	0	0	1	1	9
Municipal Score	29	32	34	27	31	33	24	19	16	21	28	294

Risk Scale: Severe=3, Moderate=2, Low=1, None=0

Emergency Management updated the history of natural hazards in Hamilton County and prepared a table documenting the past frequency, and estimated recurrence interval (probability of occurrence) for each hazard with a documented history. For example, the following table indicates that Hamilton County will experience a tornado every 4.5 years.

Hazard Frequencies for Hamilton County, Tennessee

Hazard	*Total Events*	*Years in Record*	*Recurrence Interval*	*Hazard Frequency*
Wind	308	55.5	0.18	5.55
Flooding	35	17.5	0.50	2.00
Winter Storm	23	17.5	0.76	1.31
Hail	132	55.5	0.42	2.38
Tornado	28	128	4.5	0.21

Source: NOAA National Climatic Data Center, Updated to include April 27, 2011 tornado outbreak

Flooding: Flooding causes the most significant amount of reoccurring damage in Hamilton County. Flooding primarily affects properties located in the Tennessee Valley, although mountaintop communities are susceptible to flash flood events.

- Tributaries of the Tennessee River are prone to backwater flooding.

- Flooding continues to damage properties both inside and outside of the 100-year floodplain.
- Residents often drive through standing floodwater.
- Flooding repeatedly damages some structures in the 100-year floodplain.
- Inadequate infrastructure is unable to handle stormwater in some areas of Hamilton County.
- There is a lack of comprehensive area rain gauging and stream flow monitoring capabilities.
- Flood and flash flood events exacerbate stream bank erosion.
- Drainage basin modeling and the creation of potential flood maps have not been created in most developing areas.
- There is no requirement for stream buffers in local ordinances. The Regional Planning Agency does include riparian buffers in its land use plans where appropriate. However, land use plans are advisory documents only.

GOAL: Protect lives and property by reducing the occurrence and severity of flood events in Hamilton County.

Winter Storms: Hamilton County is vulnerable to ice storms, snowstorms, and extreme weather change in the winter.

- The most common effects of winter storms are power and communication outages, and traffic accidents.
- Mountainous areas experience yearly difficulty with winter weather.
- Winter storms cause some areas to become inaccessible for extended periods of time.
- There is not an adequate plan in some jurisdictions to provide shelter for residents who lose power and heat during winter weather events.

GOAL: Reduce potential damages and increase public preparedness.

Severe Storms: Severe storms with high winds, lightening, hail, and heavy rain are possible throughout the year in Hamilton County.

- High winds cause falling limbs and trees that damage power lines and public utilities.

- Heavy rain overwhelms stormwater drainage capacity and leads to flooding of problem areas.
- Lightening has destroyed or damaged buildings by igniting fires.

GOAL: Minimize the impact of severe storms on area property and lives.

Tornadoes: Tornadoes are associated with severe thunderstorms and although infrequent, may cause substantial property damage and loss of life.

- Tornado frequency has increased significantly, with 15 documented tornados occurring between 2009 and 2011.
- There are no identified tornado shelters within Hamilton County.
- There is a substantial risk of property damage and loss of life for residents of mobile homes.

GOAL: Save lives, reduce property damage, and increase awareness of the danger of tornadoes.

Landslide/Erosion: Stream banks, steep slopes, and slopes cut for roads have the potential for failure.

- Removal of vegetation in hazard areas increases the potential for landslides.
- Heavy rain increases the probability of slope failure.
- Residents may be unaware of the potential hazard of landslides.
- Severe stream bank erosion in several areas, particularly along North Chickamauga Creek, is threatening property and structures.

GOAL: Identify high hazard areas and identify techniques to minimize risk.

Drought/Wildfire- Wildfire is the main threat associated with drought conditions.

- There is a lack of public awareness of how droughts increase the potential for wildfire.
- No public education exists on how to minimize fire risk to property located in the wildland/urban interface.
- Fire suppression on steep slopes and bluff lines is especially difficult.

GOAL: Reduce the threat of wildfire.

Earthquakes: Earthquakes are common in the East Tennessee Seismic Zone, but rarely noticeable. A major earthquake could result in significant loss of property and life.

- There is a lack of public education on earthquake hazards and preparedness.
- Older buildings and infrastructure may be severely damaged in the event of a significant earthquake.
- Hamilton County contains several critical facilities that increase the potential danger of a major earthquake.
- Steep slopes and hillsides could become unstable in the event of a major earthquake.

GOAL: Save lives, reduce potential property damage and increase public awareness.

Development of Mitigation Alternatives

The Planning Group reviewed mitigation alternatives in response to problem statements. The following mitigation alternatives form the basis for preferred actions discussed in Chapter 4.

All Hazards

- ✓ Promote Continuity of Operations/Business Continuity to business, education, medical, and government interests in the county.
- ✓ Continue public education on the hazards we face and family/personal preparedness.

Flooding

Emphasis will be to seek Federal Mitigation Grants and/or other funding sources to:

- ✓ Purchase or relocate repetitive loss structures
- ✓ Educate residents in high-risk areas
- ✓ Notification program for evacuation
- ✓ Educate property owners of responsibility for stream maintenance
- ✓ Increase stream gauging systems and early notification systems
- ✓ Identify and evaluate flood control and maintenance measures for problem areas and waterways.
- ✓ Develop map of problem non-flood zone areas
- ✓ Continue to develop basin modeling
- ✓ Apply basin modeling and flood mapping to evaluate the impact of new development projects
- ✓ Improve GIS capabilities to include real time modeling and projections of flood areas
- ✓ Increase capacity of stormwater drainage system in problem areas
- ✓ Evaluate the potential for uniform countywide stormwater and floodplain regulation
- ✓ Evaluate the potential for a countywide stream buffer ordinance

- ✓ Acquire backup power generators for stormwater and sewage pumping stations, where needed
- ✓ Continue public/private collaboration to expand greenway system countywide

Winter Storm

- ✓ Evaluate feasibility of underground utilities for problem areas and new developments
- ✓ Continue preparedness activities including providing shelters for residents that experience power outages and identifying vulnerable populations that may need additional assistance.

Severe Storm

- ✓ Early warning system
- ✓ Evaluate feasibility of underground utilities for problem areas and new developments
- ✓ Place weather alert radios in each school and day care center as well as government agencies

Tornado

- ✓ Identify public buildings for use as tornado shelters
- ✓ Public Service Announcements for mobile home residents
- ✓ Evaluate building codes and enforcement
- ✓ Public education

Landslide/Erosion

- ✓ Develop a countywide map of high risk areas
- ✓ Evaluate regulation of vegetation removal and development on steep slopes
- ✓ Evaluate the potential for a countywide stream buffer ordinance
- ✓ Continue public/private collaboration for greenway system land acquisition
- ✓ Development restrictions in susceptible areas

Drought/Wildfire

- ✓ Evaluate and map urban/wildland interface
- ✓ Public education on responsible water use during severe drought
- ✓ Public education on landscaping and building techniques to reduce property vulnerability to wildfire

Earthquake

- ✓ Retrofit existing buildings which are not compliant with current standards
- ✓ Evaluate critical infrastructure
- ✓ Public education of hazard and preparedness

Previous Plans and Studies

In preparing this plan, information from the following plans, policies, and studies was reviewed and incorporated where appropriate.

Comprehensive Plan 2030: This plan is an advisory document meant to guide future development in the county. The plan seeks to preserve sensitive areas such as floodways and steep slopes for appropriate uses that limit vulnerability.

Mountain Creek Greenway Plan 2003: This plan supports the development of greenways as a means to promote suitable use of areas subject to flood hazards.

Wolftever Creek Area Plan 2007: This plan supports the retention and expansion of riparian buffers along Wolftever Creek and its tributaries, as well as protection of steep slopes.

Hamilton County Basic Emergency Operations Plan (BEOP):
The Hamilton County BEOP includes the following Hazard Mitigation Measures.

Emergency Support Function	Responsible Agency	Mitigation Measures
ESF 3 - Infrastructure	Hamilton County/Municipal Building Inspector	Require structural mitigation measures be built into all new construction of county-owned/operated facilities
ESF 3 - Infrastructure	Hamilton County Schools	Develop structural and non-structural guidance for educational facilities to reduce the chances of student/faculty injury during all types of emergencies
ESF 3 - Infrastructure	Public Water Utility Districts and Private Water Companies	Develop emergency plans, develop back-up power capabilities, and take other preparedness measures to reduce the potential for system failures
ESF 3 - Infrastructure	Hamilton County/Municipal Wastewater Collection Systems and Treatment Facilities	Develop emergency plans, develop back-up power capabilities, and take other preparedness measures to reduce the potential for system failures
ESF 3 - Infrastructure	Chattanooga Hamilton County Health Department	Develop plans for assessing the public health consequences of malfunctioning potable water and sanitary sewer systems
ESF 12 - Energy	Electric Power Board / Volunteer Electric	Institute mitigation practices at utility distribution facilities to reduce the potential effects of hazards on the utility's ability to deliver electricity to local users.

ESF 12 - Energy	Chattanooga Gas Company	Institute mitigation practices at utility distribution facilities to reduce the potential effects of hazards on the utility's ability to deliver natural gas to local users
ESF 12 - Energy	Hamilton County Emergency Management	Develop database listing of generators and develop procedures for acquiring and deploying it with personnel to critical facilities during power failures
ESF 15 - Recovery	Hamilton County Emergency Management	Develop Local Hazard Mitigation Plans
ESF 15 – Recovery, Subfunction 15.2	Concept of Operations	The state task force will also assist the local task force in developing plans for reconstructing areas damaged by the disaster, taking into account prudent mitigation measures as identified by the State Mitigation Officer

Flood Insurance Study for Hamilton County, Tennessee (FEMA 2002): This study was used to determine historic flood events and principal flooding problems that exist in the county. The study contains flood profiles and elevation data for area streams that will be used in future modeling of flood events.

Development Trends 2010, Hamilton County: This study conducted by the Information and Research Division of the CHCRPA was incorporated into the discussion of development trends in Hamilton County.

Hamilton County Urban Growth Plan (1999): This plan was reviewed to determine county development goals and policies relevant to Natural Hazard Mitigation.

Hamilton County Local Hazard Mitigation Plan (October 1999): Background information on natural hazards in Hamilton County from the October 1999 plan was reviewed, updated, and incorporated into this document.

Reconnaissance Study - Section 905(b) (WRDA 86) Preliminary Analysis - Ecosystem Restoration and Flood Damage Reduction Study - North Chickamauga Creek Watershed - Hamilton and Sequatchie Counties, TN (Army Corps of Engineers (1998): This study was requested by the city of Soddy Daisy and Hamilton County to determine mitigation alternatives for severe stream bank erosion and flooding problems on North Chickamauga

Creek. Information from this study was used to document the history and probable causes of streambank erosion in the North Chickamauga Creek Watershed.

Floods on North Chickamauga, Mountain, and Lookout Creeks (TVA 1961); Floods on the Tennessee River, Chattanooga & Dry Creeks, and Stringers Branch (TVA 1959); Floods on the South Chickamauga, West Chickamauga, and Spring Creeks (TVA 1958): TVA studies of flooding on area creeks contributed historic documentation of flood events in Hamilton County. Data contained in the study may be useful to determine the effects of urbanization on area watersheds.

Plan Adoption

Each participating jurisdiction formally adopted the 2005 Hamilton County Natural Hazards Mitigation Plan in order to satisfy requirements of the Disaster Mitigation Act of 2000. All participating jurisdictions (Chattanooga, Collegedale, East Ridge, Lookout Mountain, Hamilton County, Red Bank, Signal Mountain, Soddy-Daisy, and Walden, UTC, and HCDE) will be required to adopt the updated plan after FEMA approval. The public will be given the opportunity to review and comment on the final plan prior to adoption. This opportunity will take place at a local board meeting for each jurisdiction before the plan adoption decision takes place. The opportunity for final public comment will therefore be documented through the receipt of a signed adoption resolution.

Chapter 3 - Hazard Analysis

The Impacts of Natural Disasters

Images of the destructive impacts of natural disasters have become commonplace in the newspapers and evening newscasts across the country. These images often portray the direct impacts of a disaster, people are killed, many others are injured, and homes, office buildings, shopping centers, and other physical structures are destroyed. In large-scale disasters, the destruction can severely interrupt work, traffic, and the daily routine of the area for months and in some cases years after the event.

Natural hazards addressed in this plan include flood, winter storms, thunderstorms and associated hail, lightning, and high wind, as well as tornadoes, earthquakes, landslide/erosion, and drought/wildfire. Natural hazards were determined through review of past events and discussion within the Planning Group. Although hurricanes affect Hamilton County, they are not addressed as a separate hazard in this plan. The Planning Group agreed that hazards that will be addressed in the plan such as severe storms, erosion, and flooding incorporate the affects of hurricane remnants that may reach our area.

Terminology

The terminology of hazard analysis is often confused by inconsistent usage of key terms. Hazard, vulnerability, and risk in many cases are used almost interchangeably; however these terms all have distinct meanings. *Hazard* refers to the occurrence of the actual event that threatens human development. *Vulnerability* refers to the susceptibility of human development to harmful impacts of that hazard. *Risk* refers to the likelihood of suffering harm from the hazard in question.

An assessment can be conducted at three levels of sophistication:

1. *Hazard identification:* Define the severity and likelihood of the natural hazards that may occur in the County.
2. *Vulnerability assessment:* Evaluate the people and property exposed to the hazard and the extent of injury and damage that may result from a hazardous event of a given intensity occurring over a certain geographic area.
3. *Risk analysis:* Incorporate the estimation of probability of a hazard occurring with the vulnerability to damage and injury.

Experts in the field of disaster management often use an array of terms with fine distinctions to describe the impacts of natural hazards. Where appropriate this plan will use terms as defined by the National Research Council in its 1999 publication entitled, “The Impacts of Natural Disasters: A Framework for Loss Estimation.”

- The *impact of a disaster is* the broadest term, and includes both market based and non-market effects. For example, market-based impacts include destruction to property and a reduction in income and sales. Non-market effects include environmental consequences and psychological effects suffered by individuals

involved in a disaster. In principle, individual impacts can be either negative or positive, though obviously the impacts of disasters are predominantly undesirable.

- The *losses* of a disaster represent market-based negative economic impacts. These consist of direct losses that result from the physical destruction of buildings, crops, and natural resources and indirect losses that represent the consequences of that destruction, such as temporary unemployment and business interruption.

- The *costs* of a disaster, as the term is conventionally used, typically refer to cash payouts by insurers and governments to reimburse some (and in certain cases all) of the losses suffered by individuals and businesses.

- The *damages* caused by a disaster refer to physical destruction, measured by physical indicators, such as the numbers of deaths and injuries or the number of buildings destroyed. When valued in monetary terms, damages become direct losses.

Methodology

This plan represents the effort of Hamilton County and participating jurisdictions to collaborate in the process of developing a Natural Hazards Mitigation Plan. The plan is not a static document, but one that represents the beginning of a continuing process. The following methodology is designed to serve as a framework to guide the continuing assessment of vulnerability. As capabilities are enhanced and new information is obtained, vulnerabilities can be analyzed in greater detail.

The vulnerability assessment is the basis of the County's hazard mitigation strategy. As used here, v*ulnerability assessment* means the evaluation of the impact of natural hazards on the human-built environment. FEMA recommends an analysis based on critical facilities and the potential for future economic losses.

The vulnerability assessment is essential so that the County and communities within the County can develop targeted strategies to reduce their exposure and potential for loss. In general, the following methodology for assessing vulnerability was used:

1. *Assess the hazards.* This assessment includes a profile of the hazard and a discussion of past history, frequency of occurrence, severity, geographic areas that could be affected and time factors such as predictability and speed of onset.

2. *Assess vulnerabilities.* Based on the potential impacts, the vulnerability of exposed structures, infrastructure, and people are described and mapped.

3. *Determine potential for future losses.* The particular method for determining the future loss potential varies from hazard to hazard. In general, however, the potential for future losses is an estimate of possible monetary losses based on a most probable case scenario and the impact analysis and vulnerability assessment for each hazard.

4. *Rank the hazard vulnerabilities*. Based on the information compiled in the vulnerability assessment, the planning group ranked the hazards to allow for quantitative comparison. This ranking was then used to assign priorities to the general mitigation goals and objectives.

Note: The improved value of property was used to calculate the potential for damages to structures that might be impacted. Improved value represents an assessor's estimate in a point in time of the price a seller could receive for the structure in a fair market transaction. From the perspective of a local unit of government, improved value represents the tax base. If a building is destroyed, the tax base decreases. Improved value is not an estimate of the replacement value of the structure.

When assessing vulnerability and designing mitigation programs, it is also useful to distinguish between the physical destruction caused by the disaster and the consequences of that destruction. There are other ways to break this down even further:

- *Primary direct losses* are those resulting from the immediate destruction of the event itself, such as water damage from a flood or structural damage from high winds.

- *Secondary direct losses* are those additional impacts that occur as a result of the primary damage, such as tornado damage resulting in a hazardous materials release or downed overhead power lines as a result of falling tree limbs after an ice storm.

- *Indirect losses* are those losses that result from the consequences of the actual physical destruction. Indirect losses include business losses due to direct physical damage to commercial structures or loss of infrastructure, loss of wages to employees, rippling effects due to the loss of wages as employees reduce their spending on other consumer products and services, the loss of function of critical facilities such as schools or health care facilities, and environmental damages.

Loss estimates from past events and projections for future losses serve as the basis for hazard mitigation efforts. Because mitigation can be costly, it is important for policymakers at all levels of government to be aware of the total *losses* of disasters—and ideally of the extent to which those losses can be reduced by various mitigation strategies—so cost-effective mitigation strategies can be designed and implemented.

Plan Update Statement: The Hazard Analysis section of the plan has been extensively updated to include new demographic information. Each hazard was reviewed by the planning group and was updated to reflect incidents that have occurred since the 2005 plan. Vulnerability analysis was updated to reflect changes in development and property values.

Existing and Emerging Conditions

Population

Population increased in Chattanooga, Collegedale, Lakesite, Ridgeside, Soddy Daisy, Walden, and unincorporated areas of the county. According to census estimates, Chattanooga and the unincorporated areas of the county added the greatest number of new residents

between 2000 and 2010. Collegedale recorded the highest percentage increase in population during the same period.

Population decreased in Lakesite, Lookout Mountain, Red Bank, and Walden during the same period.

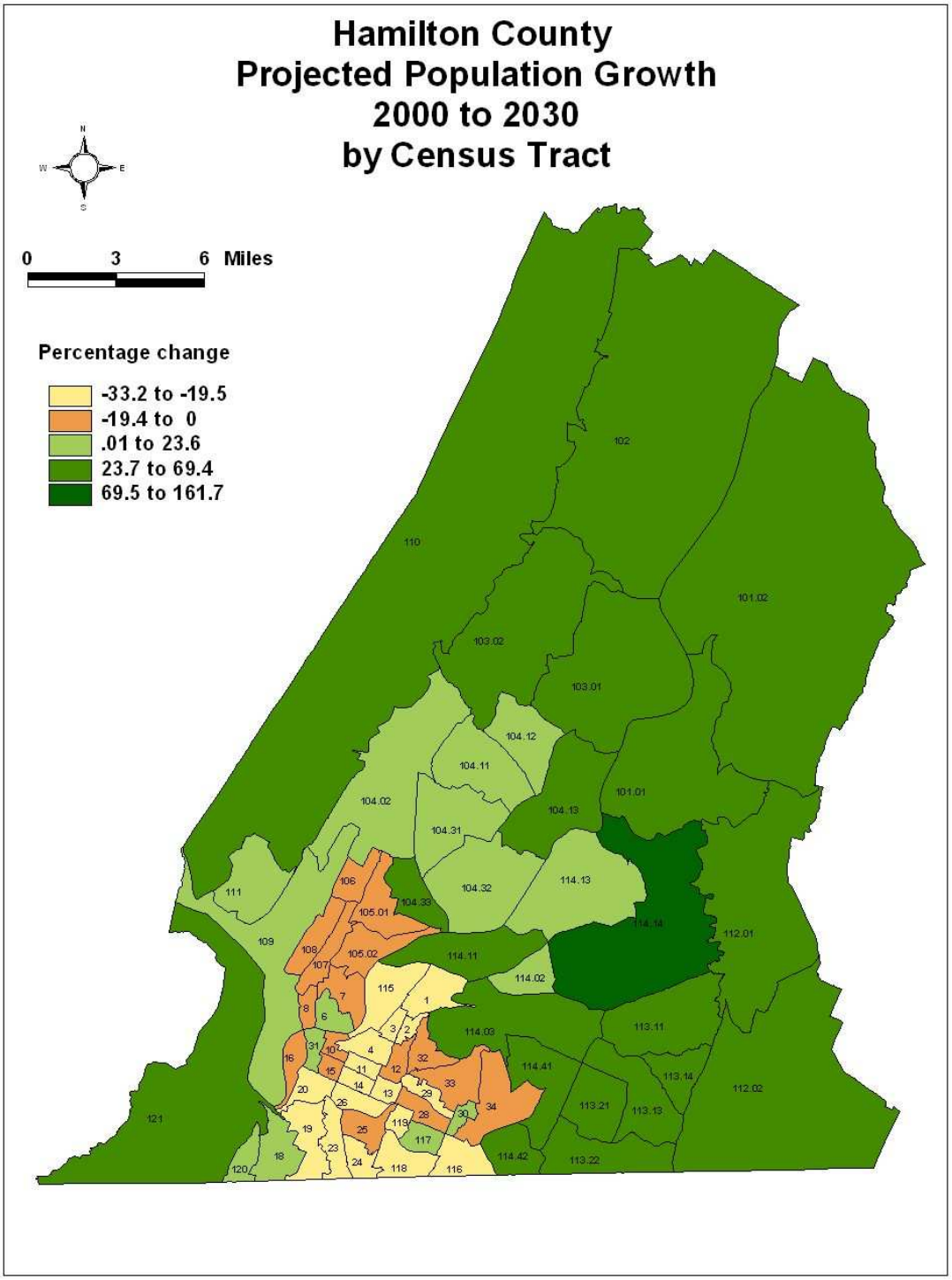
The following table illustrates population growth by jurisdiction from 1990 to 2010.

Hamilton County Population										
	Census	% of	Census	% of	Census	% of	Growth 1990-2000		Growth 2000-2010	
Jurisdiction	1990	County	2000	County	2010	County	Number	% Change	Number	% Change
Chattanooga	152,466	53.4%	155,554	50.5%	167,674	49.8%	3,088	2.0%	12,120	7.8%
Collegedale	5,049	1.8%	6,514	2.1%	8,282	2.5%	1,465	29.0%	1,768	27.1%
East Ridge	21,105	7.4%	20,640	6.7%	20,979	6.2%	-465	-2.2%	339	1.6%
Lakesite	732	0.3%	1,845	0.6%	1,826	0.5%	1,113	152.0%	(19)	-1.0%
Lookout Mountain	1,901	0.7%	2,000	0.6%	1,832	0.5%	99	5.2%	(168)	-8.4%
Red Bank	12,322	4.3%	12,418	4.0%	11,651	3.5%	96	0.8%	(767)	-6.2%
Ridgeside	400	0.1%	389	0.1%	390	0.1%	-11	-2.8%	1	0.3%
Signal Mountain	7,035	2.5%	7,429	2.4%	7,554	2.2%	394	5.6%	125	1.7%
Soddy Daisy	8,242	2.9%	11,530	3.7%	12,714	3.8%	3,288	39.9%	1,184	10.3%
Walden	1,523	0.5%	1,960	0.6%	1,898	0.6%	437	28.7%	(62)	-3.2%
Unincorporated	74,761	26.2%	87,617	28.5%	101,663	30.2%	12,856	17.2%	14,046	16.0%
County Total	285,536	100.0%	307 896	100.0%	336,463	100.0%	22,360	7.8%	28,567	9.3%
Source: U.S. Census 1990, 2000, U.S. Census 2010										

Analyses of the Census indicated population increased generally in a crescent shape from East Brainerd, Ooltewah, Hunter Road, Wolftever Creek areas, and crossed the Tennessee River to the Middle Valley and Sequoyah areas in the last decade. The analysis also showed some growth in the downtown and UTC areas.

The total projected 2030 population for Hamilton County is 362,334. This represents an increase of 54,437 people, or 17.7% over the 2000 base year population from the U. S. Census. This projection was provided by the Tennessee Department of Transportation (TDOT), and was developed by the Center for Business and Economic Research (CBER) at the University of Tennessee. The same projections were also used in the update of the Comprehensive Plan 2030 for Hamilton County. A detailed explanation of the population projection methodology is included in the Appendix. Map 3 illustrates the projected population growth of Hamilton County by census tract through the year 2030.

Map 2


Hamilton County
Projected Population Growth
2000 to 2030
by Census Tract
N
W
E
S
0 3 6 Miles
Percentage change
-33.2 to -19.5
-19.4 to 0
.01 to 23.6
23.7 to 69.4
69.5 to 161.7
102
110
101.02
103.02
103.01
104.12
104.11
104.02
104.13
101.01
104.31
104.32
114.13
106
104.33
105.01
111
109
108
105.02
107
114.14
112.01
114.11
114.02
115
1
7
8
6
3
2
114.03
113.11
31
10
4
32
16
15
11
12
114.41
113.14
112.02
20
14
13
33
29
34
26
30
113.21
113.13
121
19
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117
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24
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116
114.42
113.22
120
18

Density is important in determining an areas vulnerability to certain hazards. For example, a tornado that occurs in the unincorporated county will affect fewer people and structures than if the same tornado occurs in the more densely populated city of East Ridge. Table 5 presents a summary of the density of area population and housing units. Population density is based on 2010 data. Housing unit density is based on 2000 census data with the exception of the total for Hamilton County, which is based on 2009 census estimates. This information will be updated as the 2010 Census releases new data.

Hamilton County Area and Density							
			Square Miles			Density/Sq. Mile of Land Area	
Area	Population	Housing Units	Total Area	Water Area	Land Area	Population 2010	Housing Units 2009
Hamilton County	336,463	151,107	575.72	33.28	542.44	620.3	278.6
Unincorporated	101,663	51,702	372.24	24.53	347.71	292.4	148.7
Chattanooga	167,674	79,607	143.17	7.96	135.21	1,240.1	588.8
Collegedale	8,282	3,051	8.33	0.0	8.33	994.2	366.3
East Ridge	20,979	10,384	8.26	0.0	8.26	2,539.8	1,257.1
Lakesite	1,826	764	1.72	0.0	1.72	1,061.6	444.2
Lookout Mtn	1,832	800	1.26	0.0	1.26	1,454.0	634.9
Red Bank	11,651	6,179	6.44	0.0	6.44	1,809.2	959.5
Ridgeside	390	160	0.17	0.0	0.17	2,294.1	941.2
Signal Mtn	7,554	3,168	6.68	0.0	6.68	1,130.8	474.3
Soddy-Daisy	12,714	5,507	23.82	0.79	23.03	552.1	239.1
Walden	1,898	799	3.63	0.0	3.63	522.9	220.1
Source: 2010 Census Redistricting Data (Public Law 94-171) Summary File, Tables P1 and H1							

Land Use and Development Trends

The subdivision trend (See Table 5) shows that residential growth is expected to continue in the northern and eastern parts of Hamilton County in the next five years. Major areas likely to continue growing are:

- Soddy Daisy and areas farther to the north
- Middle Valley and Sequoyah area
- Areas north and northeast of the VAAP property (Enterprise South)
- Areas around Wolftever and Savannah Creeks
- East Brainerd and Ooltewah areas
- Lookout Valley

Major New Subdivisions By Jurisdiction 2000-2008

	Residential					Commercial				
	Number of			Average Lot Size in Acres	Percent of Lots on Sewer	Number of			Average Lot Size in Acres	Percent of Lots on Sewer
Jurisdiction	Subdivisions	Lots	Acres			Subdivisions	Lots	Acres		
Chattanooga	137	3,946	1,388	0.35	100.0%	22	139	442	3.18	100.0%
Collegedale	16	602	274	0.46	100.0%	-	-	-	-	-
East Ridge	2	38	12	0.32	100.0%	-	-	-	-	-
Lakesite	1	8	7	0.88	0.0%	-	-	-	-	-
Red Bank	2	76	66	0.87	100.0%	-	-	-	-	-
Signal Mountain	3	46	27	0.59	100.0%	-	-	-	-	-
Soddy Daisy	25	618	482	0.78	41.7%	2	11	26	2.36	100.0%
Walden	1	4	19	4.75	0.0%	-	-	-	-	-
Unincorporated Hamilton Co.	204	7,080	4,362	0.62	23.7%	3	32	36	1.13	0.0%
Totals	391	12,418	6,637	0.53	53.5%	27	182	504	2.77	82.4%

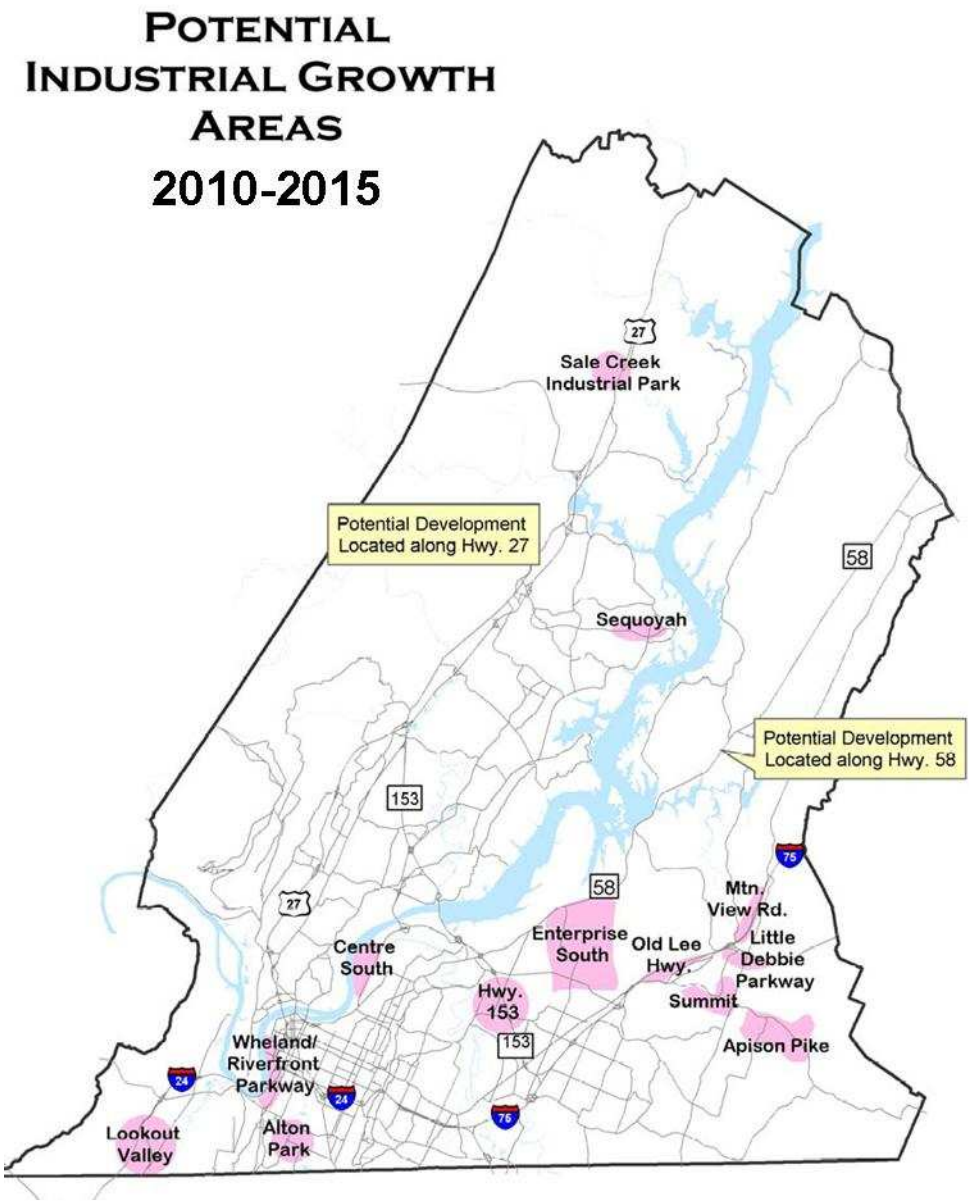
Source: Regional Planning Agency, Information and Research

Commercial development, particularly retail and services, tends to occur along the major corridors in residential growth areas. The same areas cited above as residential growth areas are likely candidates for further commercial development/expansion.

The principal areas for possible industrial and business development/expansion (See Map 3) are:

- Lookout Valley
- Alton Park
- Wheland property/Riverfront Parkway
- Centre South
- Highway 153/Shallowford Industrial Park area
- Enterprise South
- Area adjacent to Sequoyah Nuclear PlantAreas along Highways 58 and 27, and
- the Sale Creek area Summit area along Old Lee Highway and Little Debbie Parkway

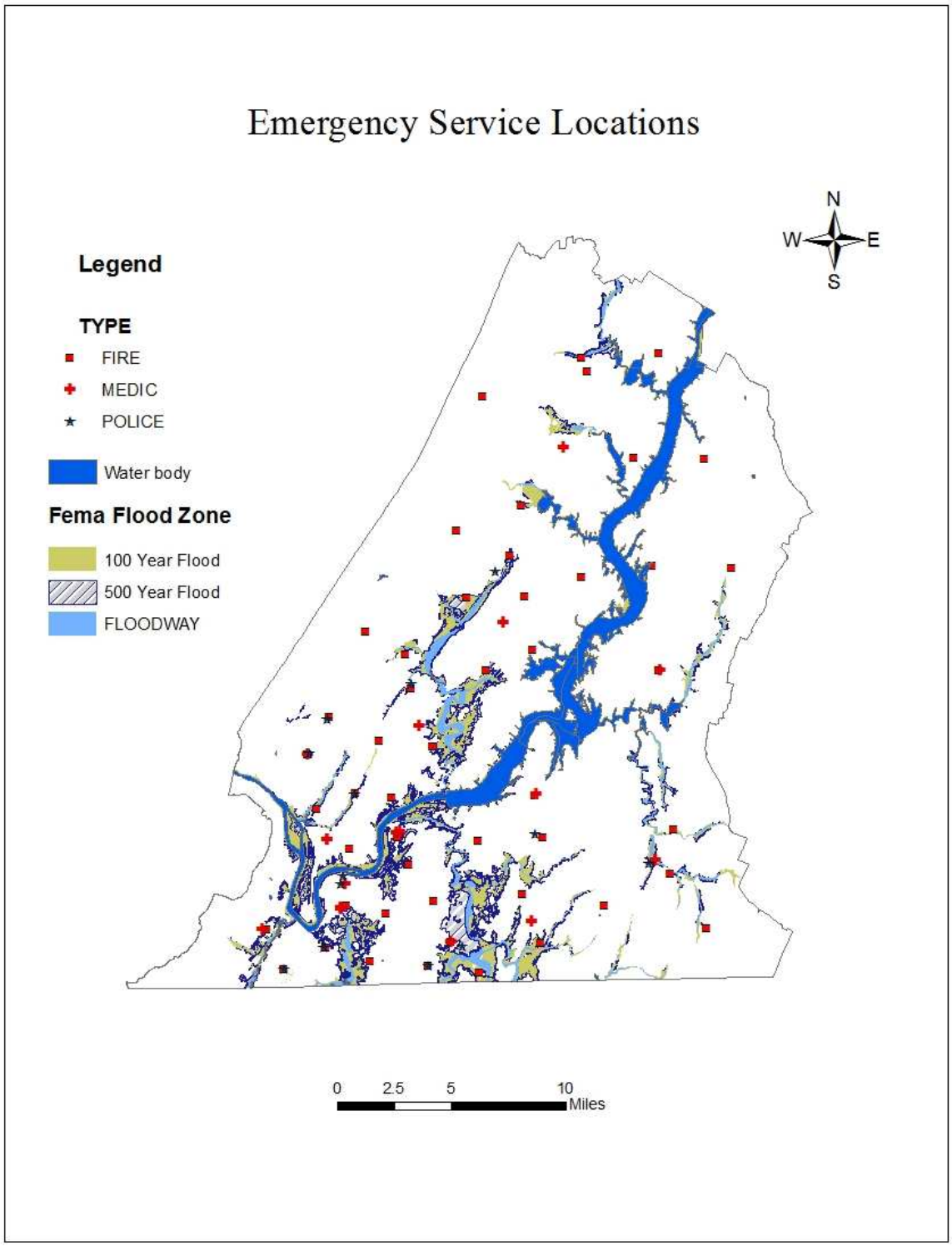
Map 3



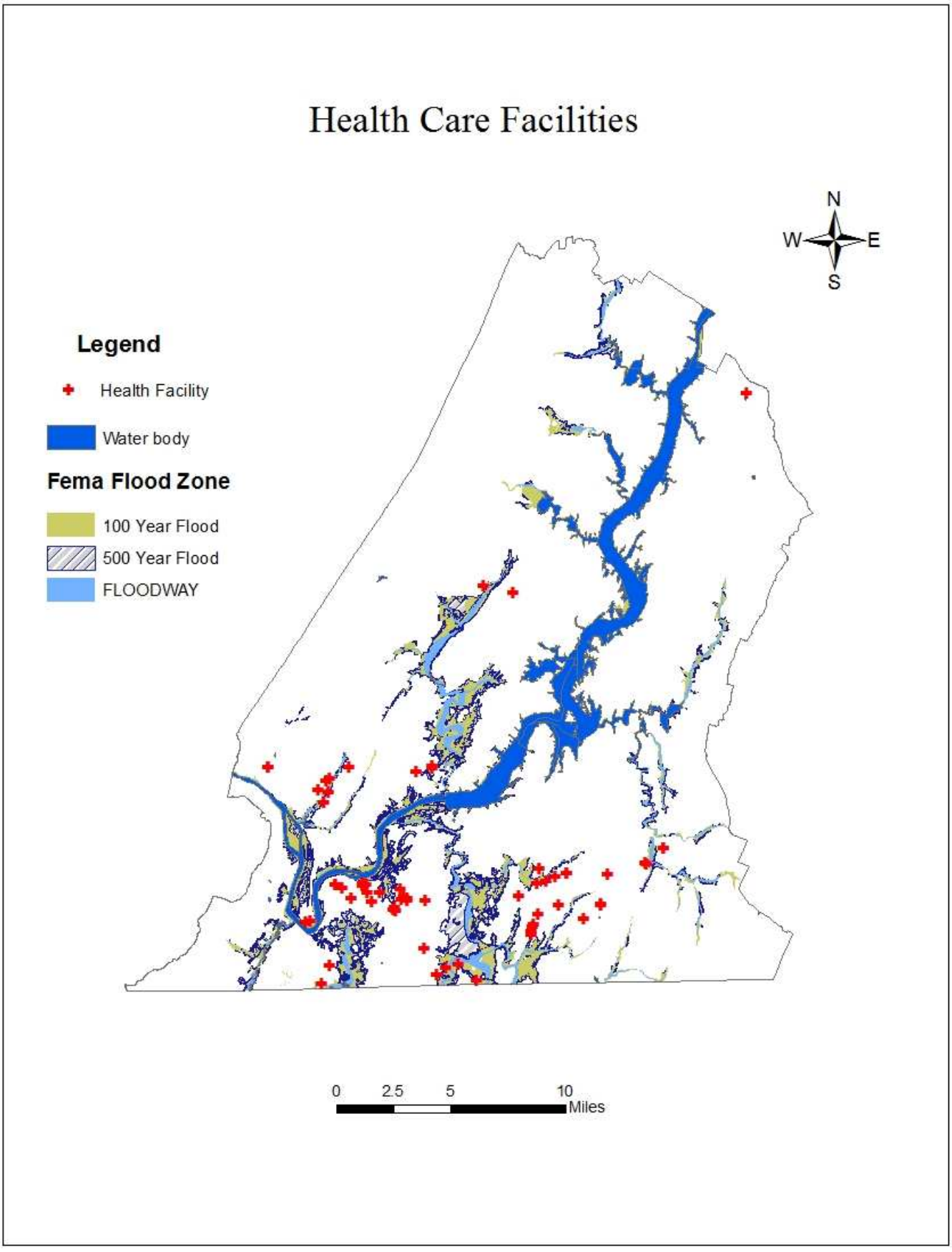
Critical Facilities

Maps 4 through nine show the location of critical facilities, including fire stations, police stations, emergency medical stations, schools, and city halls. All critical facilities are vulnerable to non-site specific hazards such as severe storms.

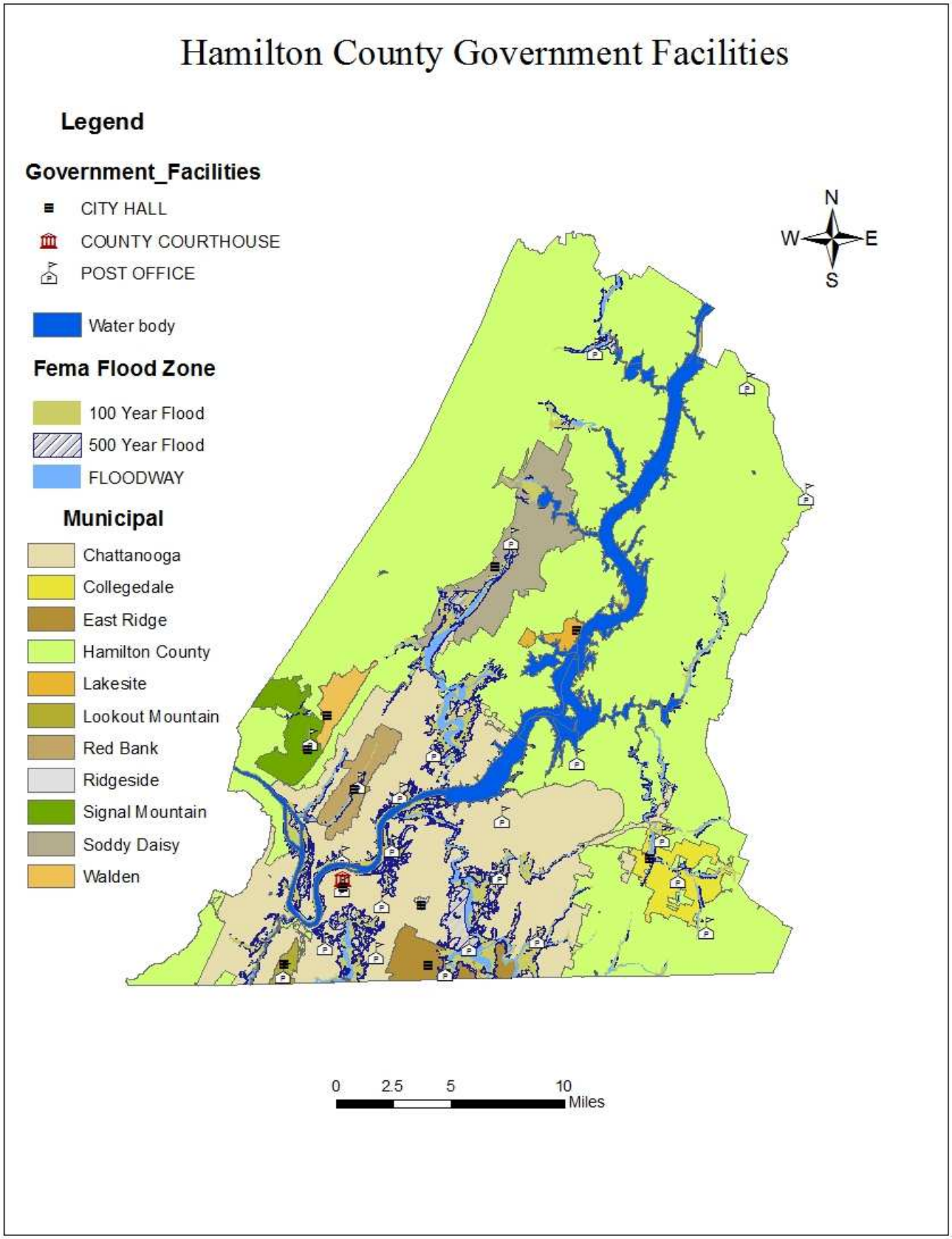
Map 4

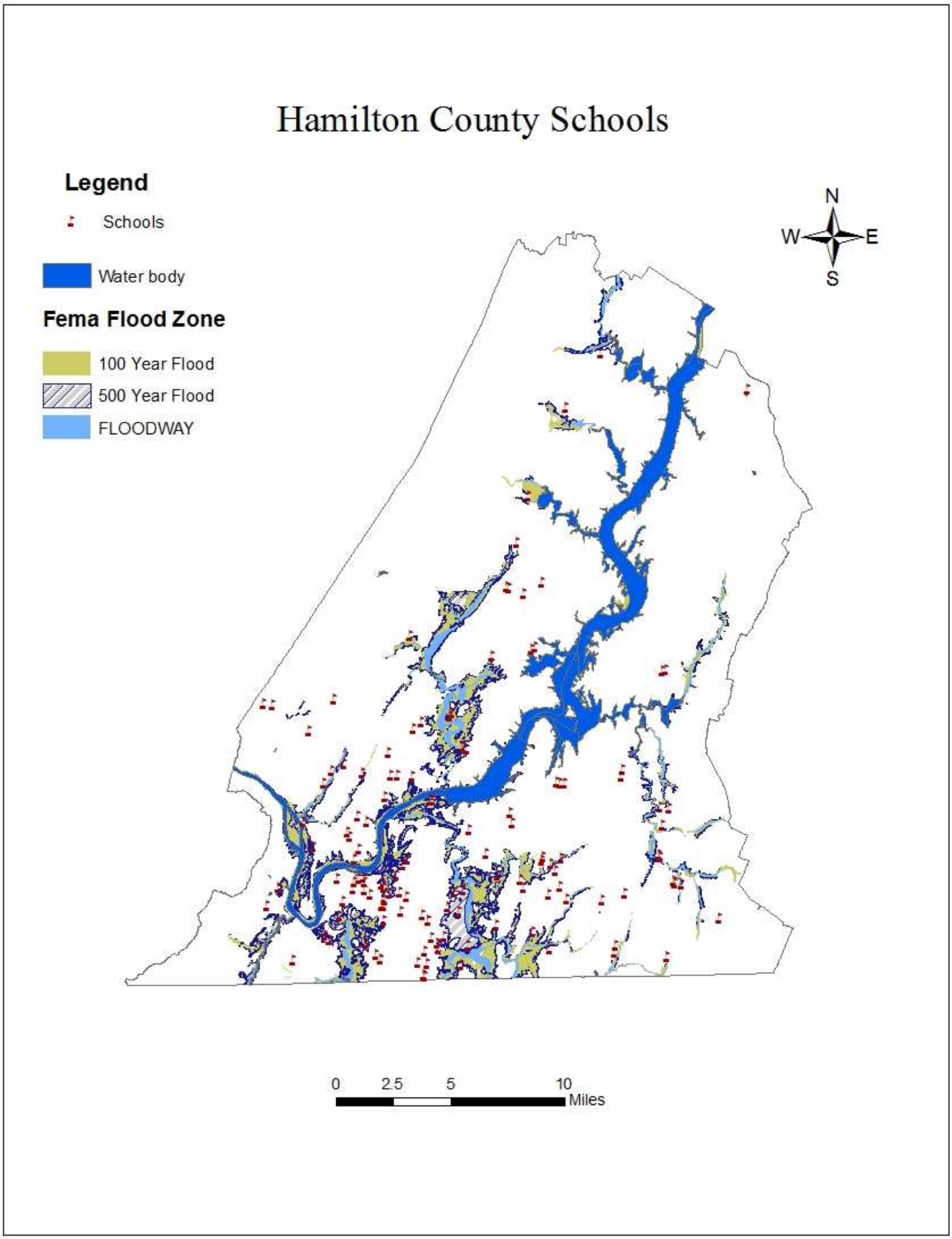


Map 5


Health Care Facilities
N
W
E
S
Legend
Health Facility
Water body
Fema Flood Zone
100 Year Flood
500 Year Flood
FLOODWAY
0
2.5
5
10
Miles

Map 6


Hamilton County Government Facilities
Legend
Government_Facilities
CITY HALL
COUNTY COURTHOUSE
POST OFFICE
Water body
Fema Flood Zone
100 Year Flood
500 Year Flood
FLOODWAY
Municipal
Chattanooga
Collegedale
East Ridge
Hamilton County
Lakesite
Lookout Mountain
Red Bank
Ridgeside
Signal Mountain
Soddy Daisy
Walden
N
W
E
S
0
2.5
5
10
Miles


Hamilton County Schools
Legend
Schools
Water body
Fema Flood Zone
100 Year Flood
500 Year Flood
FLOODWAY
N
W
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2.5
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10
Miles

Hazards, Vulnerability, and Risk

The evaluation of natural hazards must consider the differential probability, historic occurrence, and likely impact of each hazard by jurisdiction (table 6).

The **Probability of Occurrence** is based on available historic data as well assumptions derived from available hazards literature.

Probability of Occurrence

- ***High*:** Greater than 20 percent probability each year, or at least one chance in the next 5 years
- ***Moderate*:** Between a 5 and 10 percent probability in the next year, or at least one chance in the next 10 years
- ***Low*:** Between a 1 and 5 percent probability in the next year, or at least one chance in the next 20 to 100 years

Historic Occurrence is based on documentation of past events.

Historic Occurrence

- ***High:*** At least once every five years
- ***Moderate:*** At least once every 10 years
- ***Low:*** At least once in the last 20 to 100 years
- ***Unknown:*** Historic data was not available for evaluation

The **Likely Extent/Magnitude** of each hazard is inferred from past events or surmised from a worst-case scenario.

Likely Extent/Magnitude (one or more criteria may be met)

- ***Serious*:** Severe injuries, loss of life, significant property damage, evacuations and provision of emergency shelter.
- ***Moderate*:** Some injuries, property damage; disruption of area for more than 24 hours.
- ***Minimal*:** Minor injuries, disruption of the area for less than 24 hours, minor property damage.

Hazard	Jurisdiction	Probability of Occurrence	Historic Occurrence	Likely Extent/Magnitude
Flood	Unincorporated County	High (Valley) Moderate (Plateau)	High (Valley) Moderate (Plateau)	Moderate
	Collegedale	High	Moderate	Moderate
	Chattanooga	High	High	Serious
	East Ridge	High	High	Serious
	Lakesite	Low	Low	Minimal
	Lookout Mountain	Low	Low	Minimal
	Red Bank	High	High	Moderate
	Soddy-Daisy	High	High	Moderate
	Signal Mountain	Low	Low	Minimal
	Walden	Low	Low	Minimal
	UTC	High	High	Low
	HCDE	Moderate	Moderate	Moderate
Severe Storms (wind, hail, lightening)	Unincorporated County	High	High	Moderate
	Collegedale	High	High	Moderate
	Chattanooga	High	High	Moderate
	East Ridge	High	High	Moderate
	Lakesite	High	High	Moderate
	Lookout Mountain	High	High	Moderate
	Red Bank	High	High	Moderate
	Soddy-Daisy	High	High	Moderate
	Signal Mountain	High	High	Moderate
	Walden	High	High	Moderate
	UTC	High	High	Low
	HCDE	High	High	Moderate
Winter Storms	Unincorporated County	High (Plateau) Moderate (Valley)	High (Plateau) Moderate (Valley)	Serious (Plateau) Moderate (Valley)
	Collegedale	Moderate	Moderate	Moderate
	Chattanooga	Moderate	Moderate	Moderate
	East Ridge	Moderate	Moderate	Moderate
	Lakesite	Moderate	Moderate	Moderate
	Lookout Mountain	High	High	Serious
	Red Bank	Moderate	Moderate	Moderate
	Soddy-Daisy	Moderate	Moderate	Moderate
	Signal Mountain	High	High	Serious
	Walden	High	High	Serious
	UTC	High	High	Moderate
	HCDE	Moderate	Moderate	Moderate

Hazard	Jurisdiction	Probability of Occurrence	Historic Occurrence	Likely Extent/Magnitude
Tornado	Unincorporated County	Moderate	Moderate	Serious
	Collegedale	Moderate	Moderate	Serious
	Chattanooga	Moderate	Moderate	Serious
	East Ridge	Moderate	Moderate	Serious
	Lakesite	Moderate	Low	Serious
	Lookout Mountain	Moderate	Low	Serious
	Red Bank	Moderate	Moderate	Serious
	Soddy-Daisy	Moderate	Low	Serious
	Signal Mountain	Moderate	Moderate	Serious
	Walden	Moderate	Low	Serious
	UTC	Moderate	Low	Serious
	HCDE	Moderate	Moderate	Serious
Wildfire/Drought	Unincorporated County	Moderate	Moderate	Serious
	Collegedale	Moderate	Low	Moderate
	Chattanooga	Moderate	Low	Moderate
	East Ridge	Moderate	Low	Moderate
	Lakesite	Moderate	Low	Moderate
	Lookout Mountain	Moderate	Moderate	Serious
	Red Bank	Moderate	Low	Moderate
	Soddy-Daisy	Moderate	Low	Serious
	Signal Mountain	Moderate	Low	Serious
	Walden	Moderate	Low	Serious
	UTC	Low	Low	Low
	HCDE	Low	Low	Low
Erosion (Streambank)	Unincorporated County	High	High	Serious
	Collegedale	High	Moderate	Minimal
	Chattanooga	Low	Low	Minimal
	East Ridge	High	High	Moderate
	Lakesite	Low	Low	Minimal
	Lookout Mountain	Low	Low	Minimal
	Red Bank	Moderate	Moderate	Moderate
	Soddy-Daisy	High	High	Serious
	Signal Mountain	Low	Low	Minimal
	Walden	Low	Low	Minimal
	UTC	Low	Low	Low
	HCDE	Low	Low	Low

Hazard	Jurisdiction	Probability of Occurrence	Historic Occurrence	Likely Extent/Magnitude
Earthquake	Unincorporated County	Low	Low	Moderate
	Collegedale	Low	Low	Moderate
	Chattanooga	Low	Low	Serious
	East Ridge	Low	Low	Serious
	Lakesite	Low	Low	Moderate
	Lookout Mountain	Low	Low	Moderate
	Red Bank	Low	Low	Serious
	Soddy-Daisy	Low	Low	Moderate
	Signal Mountain	Low	Low	Moderate
	Walden	Low	Low	Moderate
	UTC	Low	Low	Low
	HCDE	Low	Low	Moderate
Landslide	Unincorporated County	Moderate	Unknown	Moderate
	Collegedale	Moderate	Unknown	Moderate
	Chattanooga	Moderate	Low	Moderate
	East Ridge	Moderate	Unknown	Moderate
	Lakesite	Low	Unknown	Minimal
	Lookout Mountain	Moderate	Unknown	Moderate
	Red Bank	Moderate	Unknown	Moderate
	Soddy-Daisy	Moderate	Unknown	Moderate
	Signal Mountain	Moderate	Low	Moderate
	Walden	Moderate	Unknown	Moderate
	UTC	Low	Low	Low
	HCDE	Low	Low	Low

Flood

Panoramic view of Chattanooga during the flood of 1917. Source: Hamilton County Public Library, Paul *A. Hiener Collection*

A flood is a natural event for rivers and streams. Excess water from snowmelt and rainfall accumulates and overflows onto the banks and adjacent floodplains. Floodplains are lowlands, adjacent to rivers and lakes that are subject to recurring floods (Map 5). Flooding is the most common and costly hazard in Hamilton County, and thousands of households are located within floodplains. Floods can occur at any time of the year, and at any time of day or night. Most injuries and deaths occur when people are swept away by flood currents, often when attempting to traverse floodwaters in a vehicle. Most property damage results from inundation by sediment-filled water, or by debris in floodwaters that acts as "battering rams."

Floods generally fall into two categories: *flash floods*, the product of heavy localized precipitation in a short period over a given location, or caused by a dam break or levee failure; and *general floods*, which can occur in riverine and urban settings.

Flash Flooding: Flash floods occur within a few minutes or hours of heavy amounts of rainfall or from a dam or levee failure. In Hamilton County, most flash flooding is caused by slow-moving thunderstorms or repeated thunderstorms in a local area. Areas subject to rapid floodwater inundation pose special threats to life and property because there is insufficient time for warning, evacuation, emergency floodproofing, or other protective measures. Flash floods can destroy buildings and bridges, uproot trees, and scour out new drainage channels. Heavy rains that produce flash floods can also trigger mudslides. Suddenness is a serious problem in the following areas:

- Steep rivers and streams in mountainous or hilly areas subject to sudden rainfall and rapid runoff;
- Areas with steep slopes and little or no vegetative ground cover;
- Areas behind dams or levees subject to failure or overtopping;
- Urban areas where much of the ground is covered by impervious surfaces, or where fixed drainage channels may be unable to contain the runoff that is generated by intense rainfall events.

Riverine Flooding: Riverine flooding occurs when stream flow exceeds the capacity of the normal watercourse, and is a function of precipitation levels and water runoff volumes within the watershed of the stream or river. The severity of a flooding event is determined by a combination of river basin physiography, local thunderstorm movement, past soil moisture conditions, and the degree of vegetative clearing. Abnormal weather patterns may also contribute to flooding of a local area.

Urban Flooding: Urban flooding occurs where there has been development within stream floodplains. Floodplains are often considered attractive for development since they provide flat areas for building. The price of this accessibility and convenience has been increased flooding of the ensuing urban areas. Urbanization increases the magnitude and frequency of floods by increasing impermeable surfaces, increasing the speed of drainage collection, reducing the carrying capacity of the land, and occasionally, overwhelming sanitary sewer systems.

***High Risk Factors*:**
The following conditions may exacerbate the effects of floods: impermeable surfaces, steeply sloped watersheds, constrictions, obstructions, debris, contamination, soil saturation, and velocity.

Impermeable surfaces: Excessive amounts of paved areas or other surfaces upstream or in the community can increase the amount and rate of water runoff. Development affects the runoff of stormwater when buildings and parking lots replace the natural vegetation, which normally would absorb water. When rain falls in an undeveloped area, as much as 90 percent of it will infiltrate the ground; in a highly developed area, as much as 90 percent of rainfall will run off.

Steeply sloped watersheds: In hilly and mountainous areas, a flood may occur minutes after a heavy rain. These flash floods allow little or no warning time, and are characterized by high velocities.

Constrictions: Re-grading or filling within or on the edge of floodplains obstructs flood flows, backing up floodwaters onto upstream and adjacent properties. It also reduces the floodplain's ability to store excess water, sending more water downstream and causing floods to rise to higher levels. This also increases floodwater's velocity downstream of the constriction.

Obstructions: Bridges, culverts and other obstructions can block flood flow and trap debris, causing increased flooding upstream and increased velocity downstream.

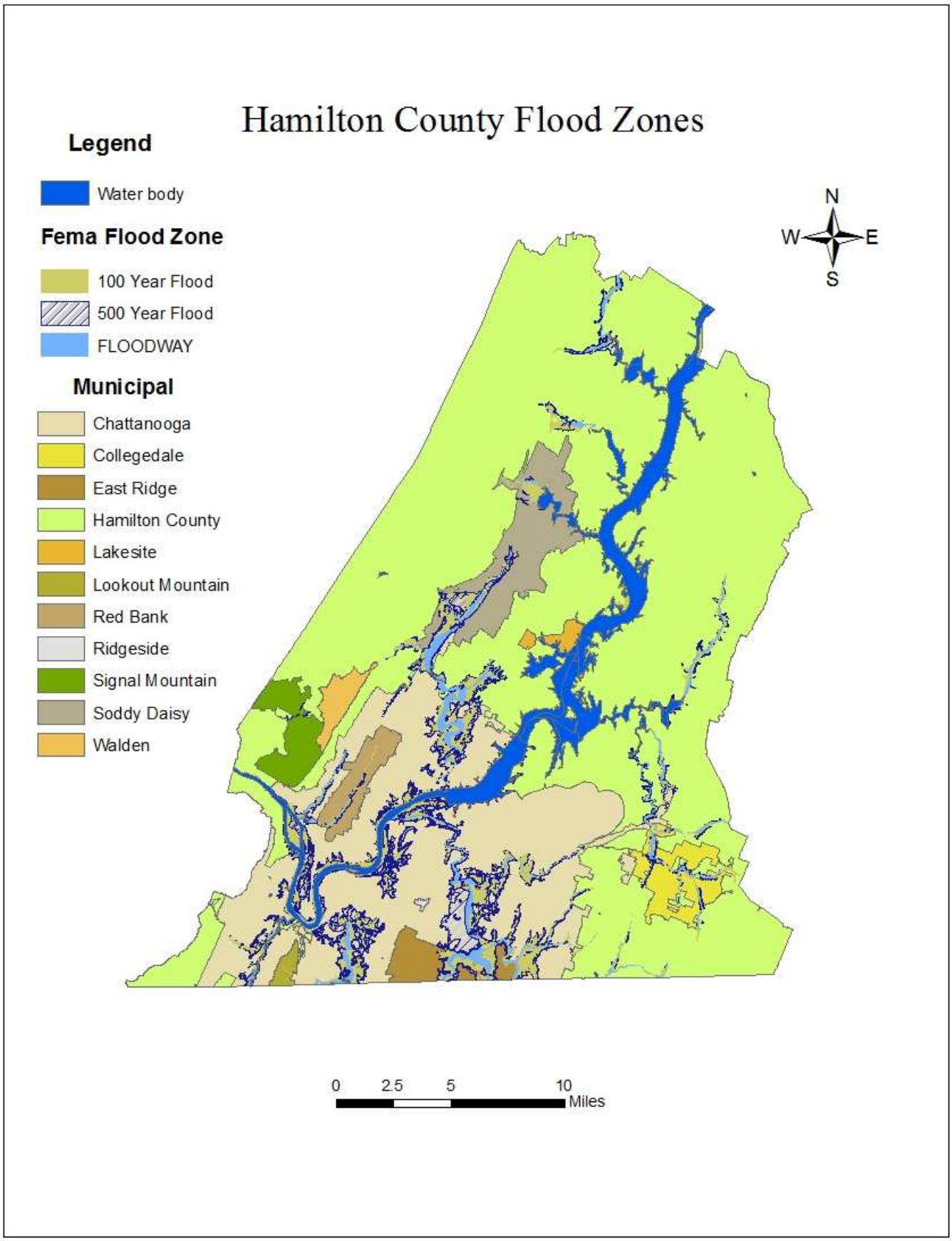
Debris: Debris from the watershed, such as trees, rocks, and parts of damaged buildings, increases the hazard posed by moving water. Moving water will float, drag or roll objects, which then act as battering rams that can knock holes in walls and further exacerbate the effects of debris.
Contamination: Few floods have clear floodwater, and the water will pick up whatever was on the ground within the floodplain, such as soil, road oil, farm and lawn chemicals, and animal waste. In addition, if a wastewater treatment plant was inundated, the floodwaters will

likely include untreated sewage. Contamination is also caused by the presence of hazardous material storage in the floodplain and in the community, as well as upstream from the community.

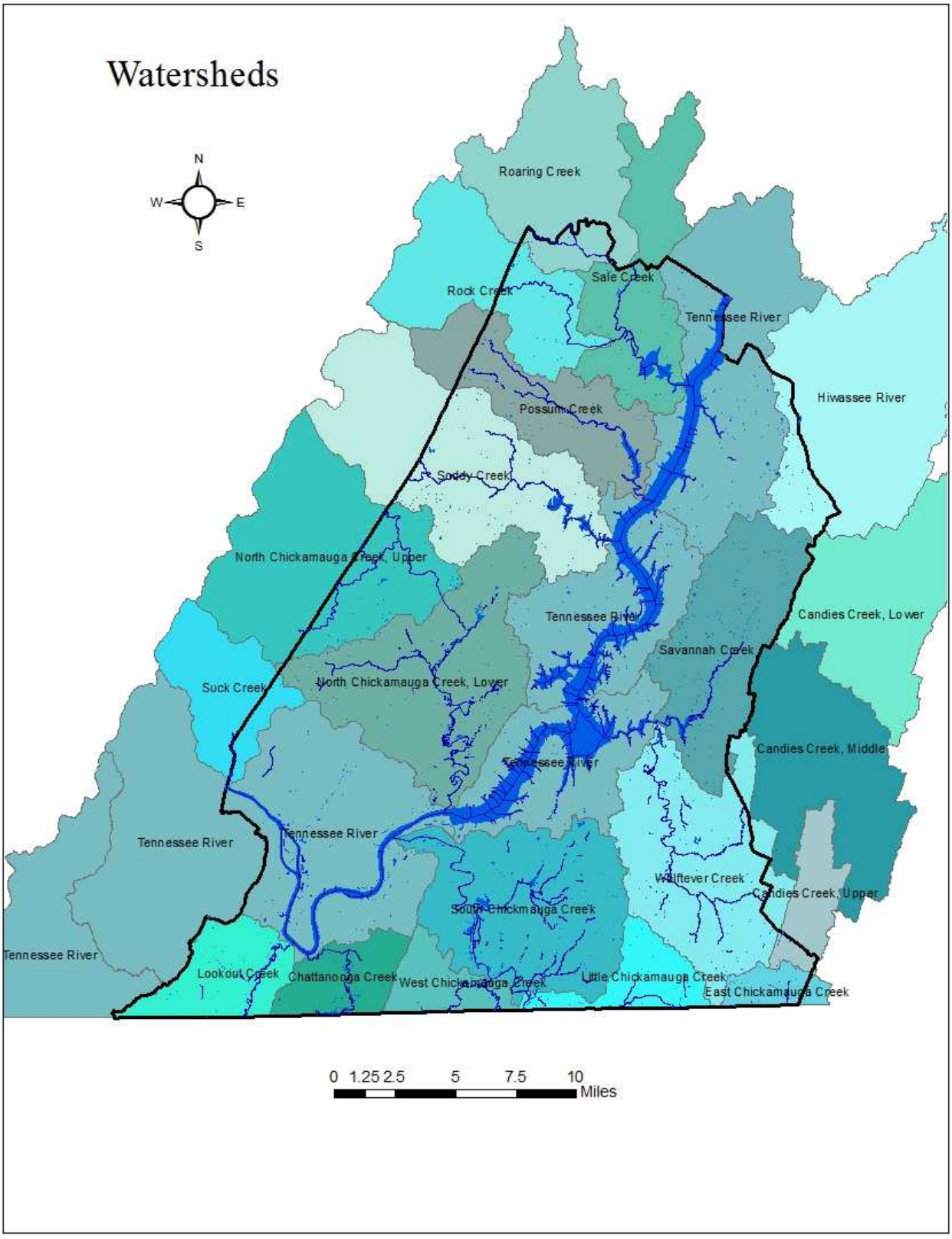
Soil saturation: Rainfall in areas already saturated with water will increase the runoff.

Velocity: Flood velocity is the speed of moving water, measured in feet per second. Velocity is determined by slope, waves, and several other factors. The damage potential of flood waters increases dramatically, sometimes exponentially, with velocity. High velocities (greater than 5 feet per second) can erode stream banks, lift buildings off their foundations, and scour away soils around bridge supports and buildings.

Map 8


Hamilton County Flood Zones
Legend
Water body
Fema Flood Zone
100 Year Flood
500 Year Flood
FLOODWAY
Municipal
Chattanooga
Collegedale
East Ridge
Hamilton County
Lakesite
Lookout Mountain
Red Bank
Ridgeside
Signal Mountain
Soddy Daisy
Walden
N
W
E
S
0
2.5
5
10
Miles

Map 9


Watersheds
N
W
E
S
Roaring Creek
Rock Creek
Sale Creek
Tennessee River
Hiwassee River
Possum Creek
Soddy Creek
North Chickamauga Creek, Upper
Tennessee River
Candies Creek, Lower
Savannah Creek
Suck Creek
North Chickamauga Creek, Lower
Candies Creek, Middle
Tennessee River
Tennessee River
Tennessee River
Wolftever Creek
Candies Creek, Upper
South Chickmauga Creek
Tennessee River
Lookout Creek
Chattanooga Creek
West Chickamauga Creek
Little Chickamauga Creek
East Chickamauga Creek
0 1.25 2.5 5 7.5 10
Miles

Significant Events

Major flood events in 1973 and 2003 affected floodplain properties along the Tennessee River, all creeks, and unnamed tributaries.
Flash flooding in 1996 and 2001 occurred along Gadd Road from the base of the ridge to North Chickamauga Creek. The Forest Plaza area from Ely and Delashmitt Roads to Hixson Pike was also affected.

March 20 1973
700 homes, 200 business and 12 factories were damaged by Tennessee River floodwaters.

Entrance to Brainerd Village shopping center (5786 Brainerd Road) during 1973 flood. Source: Daniel, Michael L.

October 5 1995
Rains from the remnants of Hurricane Opal caused widespread flooding countywide. A circus was left stranded at a campground and had to be evacuated. A number of residences and businesses were also surrounded by water and occupants had to be evacuated. There was significant flooding of the Lookout Valley/Tiftonia section of Chattanooga.

August 11 1996
Heavy rain fell within a few hours on ground already saturated from previous rains. Seventy-six homes, twenty-six businesses, four public buildings, and three churches were heavily damaged in Red Bank and Hixson. Many people were evacuated to emergency shelters. Numerous streets were flooded stranding cars and motorists.

May 6 2003
Record flooding on the South Chickamauga Creek, near record flooding on the Tennessee River, wide spread flooding, road closures, damage, and evacuations.

May 2003 View of Lee Highway looking northeast near South Chickamauga Creek and Lovell Field.

September 16-18 2004

Remnants of Hurricane Ivan moved through the area bringing heavy rain and high winds. High winds caused downed trees and limbs that led to widespread power outages. The Electric Power Board (EPB) reported approximately $900,000 in damage to power lines and public utilities in the Tennessee Valley.

There was minor and moderate flooding throughout the county. In Soddy-Daisy, a 50-foot section of Back Valley road was washed out by overflow from Possum Creek. Hamilton County road officials estimated around $500,000 in damage to area roads and bridges. The South Chickamauga reached a maximum stage of 25.1 feet, 7.1 feet above flood stage, causing evacuations and road closures in some of the low-lying areas around Spring Creek in East Ridge. There was extensive flooding of the north end of the airport. Several area creeks sustained major bank erosion that threatened homes and roadways.

September 17, 2004, Rossville Boulevard: Photograph by Blaine Headrick

September 17-24 2009

Widespread minor street flooding began, and eventually escalated into areal and river flooding. The South Chickamauga Creek exceeded its banks and flooded surrounding areas of Chattanooga and East Ridge. The West Chickamauga Creek also contributed to flooding along the South Chickamauga, and areas of East Ridge. The South Chickamauga stage reached 28.54', which is the second highest recorded stage on that river. Numerous businesses and roads were affected by the high waters, with several drivers having to be rescued after driving into flooded streets. Creeks flowing off the Cumberland Plateau in northern Hamilton County also caused flooding in the Soddy Daisy areas, closing roads. One fatality occurred on 9/20/2009, when a 46 year old man, on a wager, tried to swim across a drainage ditch full of rushing water, and was swept into the aqueduct system.

Widespread flooding in East Ridge- Photo by Amy Maxwell, Hamilton County Emergency Services 9-2009

Flood events for Hamilton County from 1990 to 2010, including estimated property damage, are presented in Table 7. From 1990 to 2003, Hamilton County experienced 33 flood events causing approximately 94 million dollars in property damage. Over the twenty-year span of the record, this equals a yearly average of approximately 4.7 million dollars in property damage.

Data obtained from the National Climatic Data Center does not document flood events prior to 1993. A list of flood events dating to 1950 was assembled by surveying local sources, and reviewing past newspaper articles and TVA reports. This list is included in the Appendix.

Hamilton County Flood Events 1990-2010						
Location or County	Date	Time	Type	Death	Injury	Property Damage
124 HAMILTON	3/23/1993	1000	Flash Flood	0	0	$ 5,000
131 Chattanooga	3/27/1994	1400	Flash Flood	0	0	$ 50,000,000
132 Chattanooga	4/15/1994	1800	Flash Flood	0	0	$ 5,000
141 Chattanooga	6/26/1994	2130	Flash Flood	0	0	$ 5,000
147 East Ridge	2/16/1995	1500	Flood	0	0	$ 1,000
167 Countywide	10/5/1995	1200	Flood	0	0	$ 20,000
171 Chattanooga	3/6/1996	2:30 AM	Flash Flood	0	0	$ 15,000
182 Red Bank	8/11/1996	8:15 PM	Flash Flood	0	0	$ 2,000,000
195 Chattanooga	6/21/1997	2:50 PM	Flash Flood	0	0	$ -
200 Countywide	10/26/1997	6:05 AM	Flash Flood	0	0	$ -
Regional	1/7/1998	12:00 PM	Flood	0	0	$ -
205 East Ridge	2/3/1998	5:00 PM	Flash Flood	0	0	$ -
233 East Ridge	1/23/1999	10:00 AM	Flash Flood	0	0	$ -
241 Chattanooga	6/30/1999	4:00 PM	Flood	0	0	$ -
242 Hixon	6/30/1999	4:50 PM	Flood	0	0	$ -
243 Red Bank	7/2/1999	1:50 PM	Flood	0	0	$ -
244 Hixon	7/2/1999	2:55 PM	Flood	0	0	$ -
252 Red Bank	4/3/2000	4:40 PM	Flood	0	0	$ -
253 Hixon	4/3/2000	7:35 PM	Flood	0	0	$ -
254 East Ridge	4/3/2000	10:07 PM	Flood	0	0	$ -
292 Chattanooga	7/28/2001	6:40 PM	Flash Flood	0	0	$ -
306 Chattanooga	6/4/2002	6:00 PM	Flash Flood	0	0	$ -
Regional	2/14/2003	12:00 PM	Flood	0	0	$ 18,100,000
318 Countywide	2/16/2003	5:00 AM	Flash Flood	0	0	$ -
Regional	2/21/2003	11:00 AM	Flood	0	0	$ -
333 Countywide	5/6/2003	12:00 AM	Flash Flood	0	0	$ 23,200,000
334 Countywide	5/8/2003	2:58 AM	Flash Flood	0	0	$ 23,200,000
374 West Portion	4/7/2005	2:05 PM	Flash Flood	0	0	$ 100,000
497 Tiftona	9/16/2009	23:30 PM	Flash Flood	0	0	$ 50,000
498 Tiftona	9/20/2009	17:00 PM	Flood	1	1	$ 455,000
499 Melville	9/25/2009	17:45 PM	Flash Flood	0	0	$ -
500 North Chattanooga	9/26/2009	13:00 PM	Flood	0	0	$ -
508 Chattanooga	3/12/2010	12:56 PM	Flood	0	0	$ -

Source: National Climatic Data Center

Mitigation efforts

Hamilton County and all local jurisdictions with the exceptions of Lakesite, Walden, and Ridgeside are participants in the National Flood Insurance Program (NFIP).

The following section documents specific actions undertaken by local governments.

East Ridge:

1. The City requested the Corps of Engineers undertake Planning, Engineering, and Design of flood control measures along Spring Creek. The locally preferred plan was "residential nonstructural" corrective measures which would include raising structures in place or removing them completely from hazard areas. There was a 25 percent local cost-sharing requirement.
2. The City also was involved with an acquisition project to purchase land and 13 repetitive loss structures from the current owners and clear the land to be held as open space at a cost of approximately $800,000.

Chattanooga:

1. Flood Control Gate – Spring Creek and N. Terrace Road
2. North Terrace Pump Station and detention pond– 314 S. Howell Avenue at N. Terrace Road
3. Earl Lane Pump Station and underground storage – 808 Lower Mill Road in the unopened ROW of Marsh Road
4. Valleybrook Pump Station and levee – 113 Valleybrook Circle
5. Brainerd Levee – Along S. Chickamauga Creek from N. Moore Road to I-75.
6. McCutcheon Road Detention Pond – 2444 Hickory Valley Road
7. Lookout Valley Detention Pond – 301 Labeling Way
8. Implementation of Routine Maintenance Practices to keep the drainage system open and flowing.
9. Require new and re-development projects to install detention measures to prevent increases in stormwater runoff from the site.
10. Buy out of repetitive loss properties along Aster Avenue.
11. Basin modeling and creation of new flood mapping techniques
12. Adopted stormwater and floodplain ordinances
13. Installed rain gauges and flow meters at key locations in the drainage system.
14. Capital planning program
15. Dual power sources for the Moccasin Bend Waste Water Treatment Plant
16. Moccasin Bend Waste Water Treatment Plant and system wide pump station infrastructure built above 100-year flood elevation.
17. All Plant, pump station controls, and CSO facilities controls now located above 100-year flood elevation.

Collegedale

1. The city works to maintain drainage capacity of Wolftever Creek by periodic inspection and removal of debris.

Development Trends
Population projections and subdivision trends indicate that growth will occur primarily in unincorporated portions of the county, downtown Chattanooga, the area around the University of Tennessee at Chattanooga, and in Soddy-Daisy. New development has the potential to alter drainage characteristics of watersheds (Map 12) possibly increasing the frequency and magnitude of flood events. Floodplain ordinances regulate but do not prohibit development within the 100-year floodplains.

Vulnerability

The county and all of its jurisdictions are affected by flooding. However, the most frequently and severely affected jurisdictions include East Ridge, Chattanooga, and Red Bank.

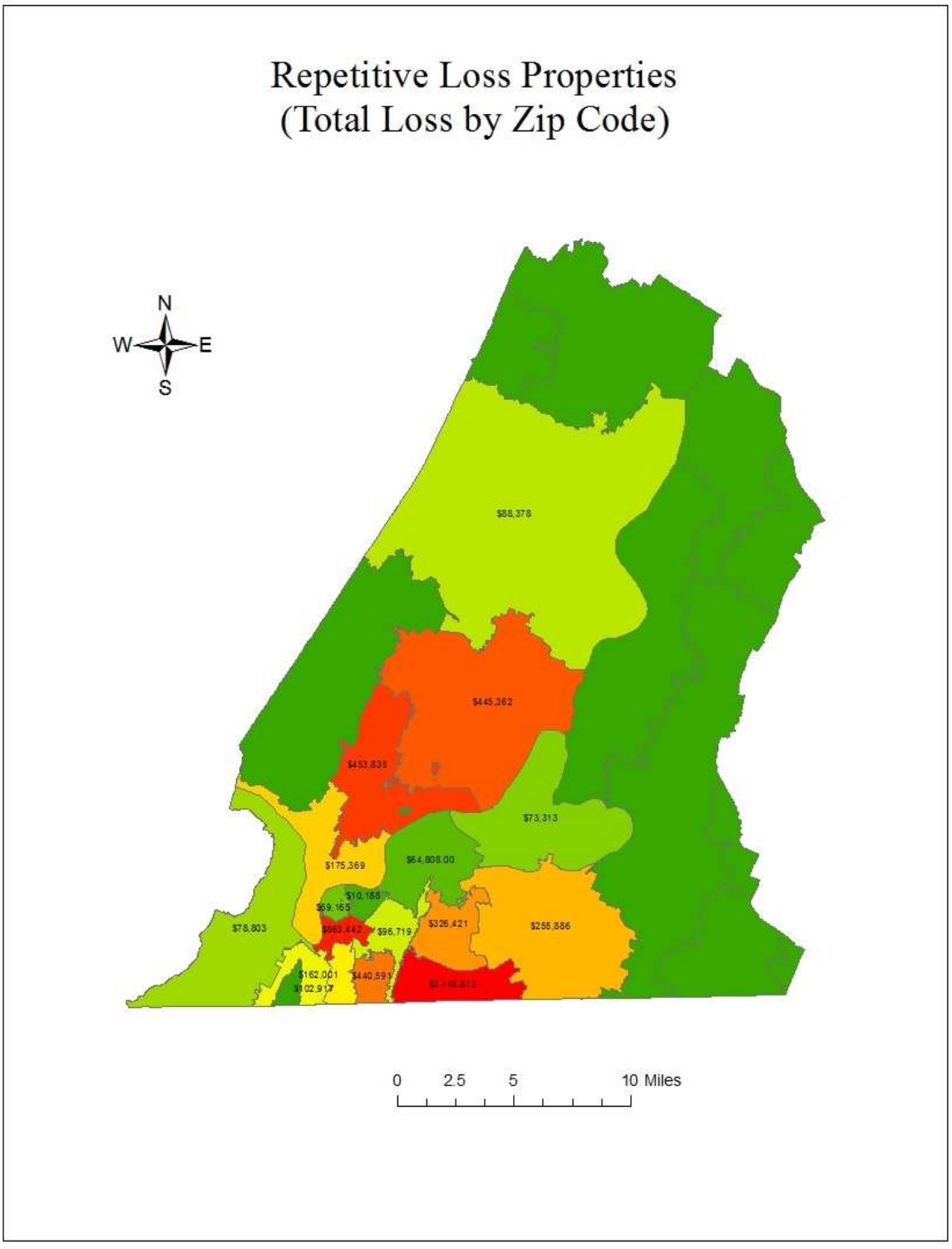
Repetitive Loss Properties

Hamilton County has 149 repetitive loss structures, according to FEMA Region IV records. Repetitive loss structure is a term associated with the National Flood Insurance Program (NFIP). Chattanooga and East Ridge have the largest number of repetitive loss structures and associated payments. For Flood Mitigation Assistance (FMA) program purposes, a repetitive loss structure is one that is covered by a flood insurance contract under the NFIP, that has suffered flood damage on two or more occasions over a 10-year period, ending on the date when a second claim is made, in which the cost to repair the flood damage, on average, equals or exceeds 25% of the market-value of the structure at the time of each flood loss event. For the Community Rating System (CRS) of the NFIP, a repetitive loss property is any property, which the NFIP has paid two or more flood claims of $1,000 or more, in any given 10-year period since 1978. A repetitive loss structure is important to the NFIP, since structures that flood frequently put a strain on the flood insurance fund. It should also be important to a community because of the disruption and threat to residents' lives by the continual flooding. The following table and map document claims paid by the NFIP by zip code.

Repetitive Loss Properties by Zip Code

Zip Code	Total Loss (Building and Contents)
37343	$445,362
37379	$88,378
37401	$39,253
37402	$69,165
37403	$10,188
37404	$96,719
37405	$175,369
37406	$64,808
37407	$440,591
37408	$863,442
37409	$102,917
37410	$162,001
37411	$326,421
37412	$3,025,828
37415	$453,835
37416	$73,313
37419	$403,544
37421	$255,886
67412	$37,118
Grand Total	$7,134,138

Map 10



The following table, prepared with GIS analysis, illustrates the appraised value of buildings by jurisdiction within the 100-year and 500-year floodplains of Hamilton County by property type. This provides a general estimate of total exposure to flood hazards. Without building

elevation data, it is difficult to estimate exact losses. Past events provide the best estimate of damage and losses that may occur as the result of future flood events. A major event such as the May 2003 floods could be expected to cause upwards of twenty million dollars in direct losses.

Appraised building value by jurisdiction and flood hazard area				
Jurisdiction	Property Type	100 Year Flood	500 Year Flood	Grand Total
Chattanooga				
	Commercial	$376,905,600	$606,195,000	$983,100,600
	Industrial	$595,783,500	$302,854,900	$898,638,400
	Residential	$126,426,500	$364,276,600	$490,703,100
	Rental	$42,637,200	$43,047,150	$85,684,350
	Apartment	$48,029,000	$296,169,600	$344,198,600
	Mobile Home Park	$146,833,100	$17,675,900	$164,509,000
Chattanooga Total		$1,372,392,600	$1,708,840,750	$3,081,233,350
Collegedale				
	Commercial	$14,945,200	$2,025,200	$16,970,400
	Industrial	$97,176,200	$1,735,300	$98,911,500
	Residential	$482,300	$1,101,800	$1,584,100
	Rental		$448,400	$448,400
	Apartment	$608,000	$17,124,000	$17,732,000
Collegedale Total		$114,697,700	$22,954,300	$137,652,000
East Ridge				
	Commercial	$202,228,000	$11,788,800	$214,016,800
	Industrial	$1,910,500		$1,910,500
	Residential	$71,929,200	$23,053,100	$94,982,300
	Rental	$6,147,700	$2,296,400	$8,444,100
	Apartment	$42,092,800	$10,772,200	$52,865,000
East Ridge Total		$324,477,400	$48,225,700	$372,703,100
Hamilton County				
	Commercial	$23,482,100	$719,700	$24,201,800
	Residential	$66,358,300	$57,725,200	$124,083,500
	Rental	$325,800	$370,900	$696,700
Hamilton County Total		$94,829,600	$71,378,900	$166,208,500
Lakesite				
	Residential	$2,614,400		$2,614,400
Lakesite Total		$2,614,400		$2,614,400
Lookout Mountain	Residential	$1,521,300		$1,521,300
Lookout Mountain Total		$1,521,300		$1,521,300
Red Bank				
	Commercial	$23,164,900	$2,641,900	$25,806,800
	Industrial	$1,415,400	$988,800	$2,404,200
	Residential	$13,010,100	$6,121,700	$19,131,800
	Rental	$1,024,500	$1,539,350	$2,563,850
	Apartment	$9,862,000	$3,219,200	$13,081,200
Red Bank Total		$48,978,700	$14,510,950	$63,489,650
Soddy Daisy				
	Commercial	$13,064,100	$31,827,000	$44,891,100
	Industrial	$19,518,100	$2,307,400	$21,825,500
	Residential	$58,787,700	$42,952,600	$101,740,300
	Rental	$1,442,700	$5,611,900	$7,054,600
	Apartment		$9,100,000	$9,100,000
	Mobile Home Park		$77,863,500	$77,863,500
Soddy Daisy Total		$95,474,400	$169,662,400	$265,136,800
Grand Total		$2,052,371,700	$2,035,573,000	$4,087,944,700

Severe Storms/Thunderstorms

Thunderstorms are the result of convection in the atmosphere. They are typically the by-product of atmospheric instability, which promotes the vigorous rising of air parcels that form cumulus and, eventually, the cumulonimbus (thunderstorm) cloud.

These storms can become severe, producing strong winds, frequent lightning, hail, downbursts, and even tornadoes. A typical thunderstorm may be three miles wide at its base, rise to between 40,000 to 60,000 feet in the troposphere, and contain half a million tons of condensed water. Conglomerations of thunderstorms along cold fronts (with squall lines) can extend for hundreds of miles.

According to the National Weather service, a severe thunderstorm is one that produces tornadoes, hail 0.75 inches or more in diameter, or winds of 50 knots (58 mph) or more. Structural wind damage may imply the occurrence of a severe thunderstorm. Hail, formed by the accretion of supercooled liquid water on ice particles in a thunderstorm updraft, can pose a serious threat to agriculture and exposed objects. Likewise, strong winds can potentially wreak havoc on fragile or flimsy structures, or yield secondary damage through the downing of trees. Lightning associated with thunderstorms poses a threat to people and animals in unsheltered areas. The tornado, however, is by far the greatest natural hazard threat associated with severe thunderstorms.

Thunderstorms and related hail, lightning, and high winds are the most frequent natural hazard to affect Hamilton County. Since 1950, The NCDC has documented 294 significant thunderstorm related weather events causing an average of $97,440 in annual property damage.

Significant Events

September 1 1995

A thunderstorm downburst caused a marina to collapse and sink or damage 20-25 boats. This storm also knocked down several trees and electrical lines. One tree fell on a residence.

July 4 1997

Two-inch hail was reported between Chattanooga and Collegedale. One-inch hail was reported in East Brainerd. Trees were down countywide and approximately 50,000 residents were without power after the storm.

June 10 1999

Lightning ignited a 3-Alarm fire, destroying the 50-year old East Ridge Presbyterian Church.

October 24 2001

Records indicate that over $75,000 of property damage occurred along with a fatality from this event.

July 13 2006

Records indicate that over $35,000 of property damage occurred from this event.

Mitigation efforts

- There is countywide tree trimming in utility right of ways.
- Hamilton County Office of Emergency Services has the capability to monitor weather systems, as well as the potential intensity of the storms, via NWS and other electronic means.
- The National Weather Service issues watches and warnings to the public and government agencies.

Development Trends

Severe storms are a non-site specific hazard; therefore, current development trends have no effect. However, population growth and new development increase the number of persons and property that could be impacted by storm events.

Vulnerability

Thunderstorms are a random occurrence. The county and all of its jurisdictions are affected by severe storms. Historic events documented by the National Climatic Data Center (NCDC) were examined to determine past damages. Since 1950, The NCDC has documented 294 significant thunderstorm related weather events causing an average of $97,440 in annual property damage.

Data provided by the National Weather Service office in Morristown, TN indicates the probability that Hamilton County will experience approximately four major thunderstorm events each year with damaging winds and/or hail.

Winter Storms

Hamilton County is vulnerable to ice storms, snowstorms, and extremely cold weather. The most common effects of winter storms are power failure and traffic accidents. In 1993, Tennessee experienced a winter storm killing 18 people and causing $22 million in damage. The Hamilton County area experienced serious damage to the power grid causing many residents to be without power for up to three weeks. Ice storms in 1994 and 1995 caused power outages in mountainous areas and left many residents isolated for up to ten days. Lookout Mountain, Signal Mountain, and Walden experience some difficulty with winter storms every year. Icing of roadways limits access to residences and services. Power and communication outages and debris caused by fallen trees and limbs are common occurrences.

Between 1950 and 2010, data records show Hamilton County to have had 17 ice storm events, 52 winter storm events, 48 heavy snow events, and 31 winter weather events. The severity of winter storms is commonly measured by inches of snowfall. Based on previous occurrences, it is possible for snowfall to accumulate over 6 inches in Hamilton County.

March 3, 1960 Ice storm on Walden's Ridge, Signal Mountain, Tennessee. Paul A. Hiener Collection

Mitigation efforts

All local jurisdictions stockpile sand and salt for use in winter storm events. There is also countywide tree trimming in utility right of ways to reduce the potential for damage to utilities.

Development Trends

Winter storms are a non site-specific hazard; therefore, current development trends have no effect. However, population growth and new development increase the number of persons and property that could be impacted by storm events.

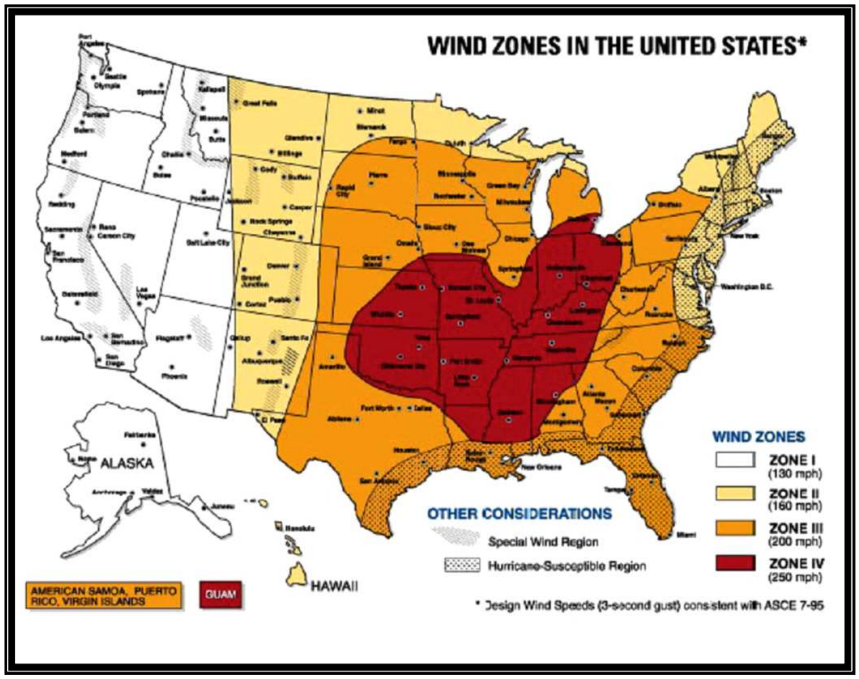
Vulnerability

Winter storms are a random event that can affect any or all parts of the County. However, Lookout Mountain, Signal Mountain, Walden, and unincorporated areas located in mountain areas are at increased risk. Analysis of data provided by the Morristown, TN. National Weather Service office indicates the probability that Hamilton County will experience two major winter storms each year.

Tornadoes

A tornado is a violently rotating column of air extending to the ground. The following wind map of the United States shows that Hamilton County is in Zone IV, with potential wind speeds of 250 mph or more. Damage paths can be in excess of 1 mile wide and 50 miles long. Tornadoes are among the most unpredictable of weather phenomena. Tornado season runs ordinarily from March through August; however, tornadoes can strike at any time of the year if the essential conditions are present.

Map 11



Cause of Tornadoes:

Thunderstorms and hurricanes spawn tornadoes when cold air overrides a layer of warm air, causing the warm air to rise rapidly. The winds produced from wildfires have also been known to produce tornadoes. The nature of tornadoes is that they strike at random. Predicting exactly what parts of Hamilton County have a greater chance of being struck by a tornado is difficult if not impossible.
Analysis of historical events documented by the National Weather Service in Morristown, TN. indicates a 14 percent yearly probability for a tornado event in Hamilton County.

The following table summarizes the historical record of tornadoes that have occurred in Hamilton County.

Documented Tornadoes in Hamilton County TN						
Date	Time (LST)	Dead	Injured	Path Length (miles)	Rating	Location
4/22/1883	11:00 PM	0	0	1	F2	Chattanooga
5/20/1883	4:00 PM	0	0	?	F2	Soddy-Daisy
4/30/1909	2:00 PM	0	8	?	F2	Red Bank
3/25/1935	9:00 PM	0	4	4	F2	Soddy
4/3/1974	3:50 PM	0	2	5.9	F1	near New Point
8/12/1977	7:30 PM	0	0	0.1	F0	Chattanooga
6/24/1980	4:20 PM	0	0	?	F0	East Brainerd
10/4/1990	8:15 AM	0	0	1.8	F1	Chattanooga

4/15/1994	11:30 AM	1	2	2	F3	Birchwood
4/21/1995	1:20 AM	0	0	0.1	F0	Red Bank
4/21/1995	1:25 AM	0	0	5	F2	Chattanooga to Hixson
4/21/1995	1:30 AM	0	0	1	F1	Chattanooga
3/29/1997	1:10 AM	0	44	8	F3	Chattanooga
4/10/2009	3:23 PM	0	0	0.5	EF1	Sale Creek
10/25/2010	5:00 AM	0	0	0.1	EF0	Harrison
10/26/2010	5:50 PM	0	6	1.2	EF2	Chattanooga (Chickamauga Dam)
2/28/2011	2:25 PM	0	0	2.2	EF1	Signal Mountain
2/28/2011	2:30 PM	0	0	2.6	EF1	near Red Bank
4/27/2011	7:55 AM	1	0	1.5	EF2	Lookout Valley
4/27/2011	8:04 AM	0	0	2	EF1	near Red Bank
4/27/2011	8:04 AM	0	0	2.2	EF1	near East Ridge
4/27/2011	8:08 AM	0	0	0.5	EF1	near Harrison
4/27/2011	9:00 AM	0	0	0.6	EF1	near Birchwood
4/27/2011	2:08 PM	0	0	7	EF1	near Ooltewah to near Georgetown
4/27/2011	5:03 PM	0	0	3.8	EF1	near Ridgeside
4/27/2011	5:14 PM	0	0	3.6	EF1	near Ooltewah
4/27/2011	5:15 PM	0	0	4	EF1	near East Ridge
4/27/2011	7:27 PM	8	100	4	EF4	near Apison

Source: NWS Morristown http://www.srh.noaa.gov/mrx/?n=td_hamilton_tn

Significant Events

April 21 1995

A tornado touched down over parts of suburban Chattanooga. The tornado caused most of its damage in a 16-block area. Overall 80 buildings were damaged. Of the 80 buildings damaged, 50 of them were homes and 30 of the buildings were businesses. Several apartments suffered roof damage and 43 persons were evacuated.

February 29 1997

An F3 tornado first touched down in the Tiftonia area just west of downtown Chattanooga. As the tornado moved due east across the southern part of Hamilton county, 50 homes were completely destroyed. Another 600 homes and 1 business were heavily damaged. Forty-four people were injured and property damage was estimated at 45 million dollars. Most of the damage area was concentrated in the East Brainerd area. Approximately 200,000 homes were without power after the storm.

October 26, 2010

A tornado hit near south Chickamauga dam with damage to a cement plant, homes, and multiple vehicles. Numerous trees and power lines were down.

February 28, 2011

Two tornados struck Hamilton County. One cut a path through Signal Mountain, while the second crossed through North Chattanooga and Red Bank. No fatalities were recorded but there was widespread damage with numerous trees and power lines down.

April 27, 2011

Ten tornados devastated Hamilton County on April 27, 2011. An EF 2 tornado struck Lookout Valley at 7:55 am and caused extensive damage. Tornados continued to track through the county throughout the day. The last tornado was an EF 4 that struck the Apison community in the southeastern part of the county causing 8 fatalities. Emergency Management estimated almost 20 million dollars in residential property damage throughout the county. The cost to local governments and utilities totaled more than 27 million dollars.

Mitigation efforts

- Hamilton County Office of Emergency Services has the capability to monitor weather systems, as well as the potential intensity of the storms, via NWS and other electronic means.
- The National Weather Service issues watches and warnings to the public and government agencies.

Development Trends

Tornadoes are a non site-specific hazard; therefore, current development trends have no effect. However, population growth and new development increase the number of persons and property that could be impacted by a tornado.

Vulnerability

Recent weather trends point to the likelihood of an increased frequency of tornadic activity in the southeast. Hamilton County and all of its jurisdictions are equally vulnerable to the devastating effects of tornados.

Drought/Wildfire

Both urban and rural areas of Hamilton County are vulnerable to drought or prolonged periods without rainfall. Drought affects agriculture, urban water supply, and causes dry conditions in forested areas, which increases the risk of wildfires. The entire state of Tennessee, including Hamilton County, has the potential for a significant drought every 15 years.

The severity of a drought is commonly measured using the Palmer Drought Severity Index (see following chart). Based on previous occurrences, it is possible for the extent of drought to exceed -4.0 (moderate drought) in Hamilton County as seen between August 2007 and January 2008.

Palmer Drought Severity Index	
Rating	Classification
4.0 or higher	extremely wet
3.0 to 3.99	very wet
2.0 to 2.99	moderately wet
1.0 to 1.99	slightly wet
0.5 to 0.99	incipient wet spell
0.49 to -0.49	near normal
-0.5 to -0.99	incipient dry spell
-1.0 to -1.99	mild drought
-2.0 to -2.99	moderate drought
-3.0 to -3.99	severe drought
-4.0 or lower	extreme drought

Source: http://drought.unl.edu/

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed and spread quickly and are usually signaled by dense smoke that fills the air for miles around. Naturally occurring and non-native species of grasses, brush, and trees fuel wildfires. On average, local fire departments respond to five wildfires a month during the summer months. The fires are normally contained within a four-hour period.

A wildland fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar facilities.

An Urban-Wildland Interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels.

The severity of wildland fires can be measured by the potential of burnable acres. In a worse cause scenario it is possible for several thousand acres to burn from a wildland fire in Hamilton County.

Causes of Wildfires

People start more than four out of every five wildfires, usually as debris burns, arson, or carelessness. Lightning strikes are the next leading cause of wildfires.

Factors Affecting Wildfire Behavior

Wildfire behavior is based on three primary factors: fuel, topography, and weather.

Fuel: The type and amount of fuel, as well as its burning qualities and level of moisture affect wildfire potential and behavior. The continuity of fuels, expressed in both horizontal and vertical components is also a factor, in that it expresses the pattern of vegetative growth and open areas.

Topography (slope) is important because it affects the movement of air (and thus the fire) over the ground surface. The slope and shape of terrain can change the rate of speed at which the fire travels. In general terms, the steeper the slope of the land, the faster a fire can spread up the slope.

Weather affects the probability of wildfire and has a significant effect on its behavior. Temperature, humidity, and wind (both short and long term) affect the severity and duration of wildfires.

Significant Events

During the drought of 1987, wildfires destroyed over 10,000 acres in Hamilton County. Drought conditions caused the Chattanooga Tennessee American Water Company to set up a number of public water distribution points.

One of Hamilton County's more recent wildfires occurred in October 2010 where multiple agencies fought three separate wildfires along the Cumberland Trail in the span of a few weeks. No homes were reportedly damaged from these events and no one had to be

evacuated. The first fire impacted approximately 50 acres near Soddy Daisy, the second burned nearly 200 acres in Sale Creek, and the third occurred near Montlake Road. Because of the elevated levels for fire outbreaks during this timeframe, Tennessee State Parks put a temporary ban on backcountry campfires.

According to NOAA's NCDC Historical Palmer Drought Index recorders, between January 1990 and March 2012, Hamilton County had "severe" droughts (-3.00 to -3.99) during March 2007, May 2007, July 2007, & February 2008 thru November 2008 and "extreme" droughts (-4.00 and below) during June 2007 & August 2007 thru January 2008. For the extreme drought of August 2007 to January 2008, Hamilton County was a part of a Statewide Drought Task Force.

Mitigation efforts

As a result of the drought of 1987, local drought preparedness procedures and plans were developed. Water utility provider inter-connect agreements developed by local governments provide a means of supplying potable water to utility districts that exhaust their supply. Signal Mountain has an "Emergency Plan for Water System," which includes a *water shortage ordinance* with procedures for drought or interruption of water distribution.

Current Development Trends

Development in rural areas is increasing the urban/wildland interface. Population projections indicate substantial growth will occur in the unincorporated portions of Hamilton County, possibly increasing the urban/wildland interface. Economic development and population growth will also increase the demand for water, increasing the impact of drought conditions.

Vulnerability

The county and all of its jurisdictions may be affected by a serious drought. Lookout Mountain, Signal Mountain, and Walden are located in areas where steep forested slopes are vulnerable to the risk of wildfire.

Landslides and Erosion

Common throughout the mountainous Appalachian region, landslides are described as downward movement of a slope and materials under the force of gravity. The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Landslides are influenced by human activity (mining and construction of buildings, railroads, and highways), and natural factors (geology, precipitation, and topography).

Causes of Landslides:

Landslides occur when masses of rock, earth, or debris move down a slope. Therefore, gravity acting on an overly steep slope is the primary cause of a landslide. They are activated by storms, fires, and by human modifications to the land. New landslides occur as a result of rainstorms, earthquakes, and various human activities such as clear-cutting.

Predicting Landslides:

The best predictor of future landslides is past landslides because they tend to occur in the same places. Existing or old landslides may be found in the following areas:

• On or at the base of slopes
• In or at the base of minor drainage hollows
• At the base or top of an old fill slope
• At the base or top of a steep cut slope
• Developed hillsides where leach field septic systems are used

High Risk Factors:
The following conditions may exacerbate the effects of landslides:

• Erosion: Erosion caused by rivers create overly steep slopes.

• Unstable Slopes: Rock and soil slopes are weakened through saturation by snowmelt or heavy rains.

• Earthquakes: The shaking from earthquakes creates stress that makes weak slopes fail.

• Vibrations: Machinery, traffic, blasting, and even thunder may cause vibrations that trigger failure of weak slopes.

• Increase of Load: Weight of rain/snow, fills, vegetation, stockpiling of rock or ore from waste piles, or from man-made structures may cause weak slopes to fail.

• Hydrologic Factors: Rain, high water tables, little or no ground cover, numerous freeze/thaw cycles may cause weak slopes to fail.

• Human Activity: These include development activities such as cutting and filling along roads and removal of forest vegetation. Such activities are capable of greatly altering slope form and ground water conditions, which can cause weak slopes to fail.

• Removal of Lateral and Underlying Support: Erosion, previous slides, road cuts and quarries can trigger failure of weak slopes.

• Increase of Lateral Pressures: Hydraulic pressures, tree roots, crystallization, swelling of clay soil may cause weak slopes to fail.

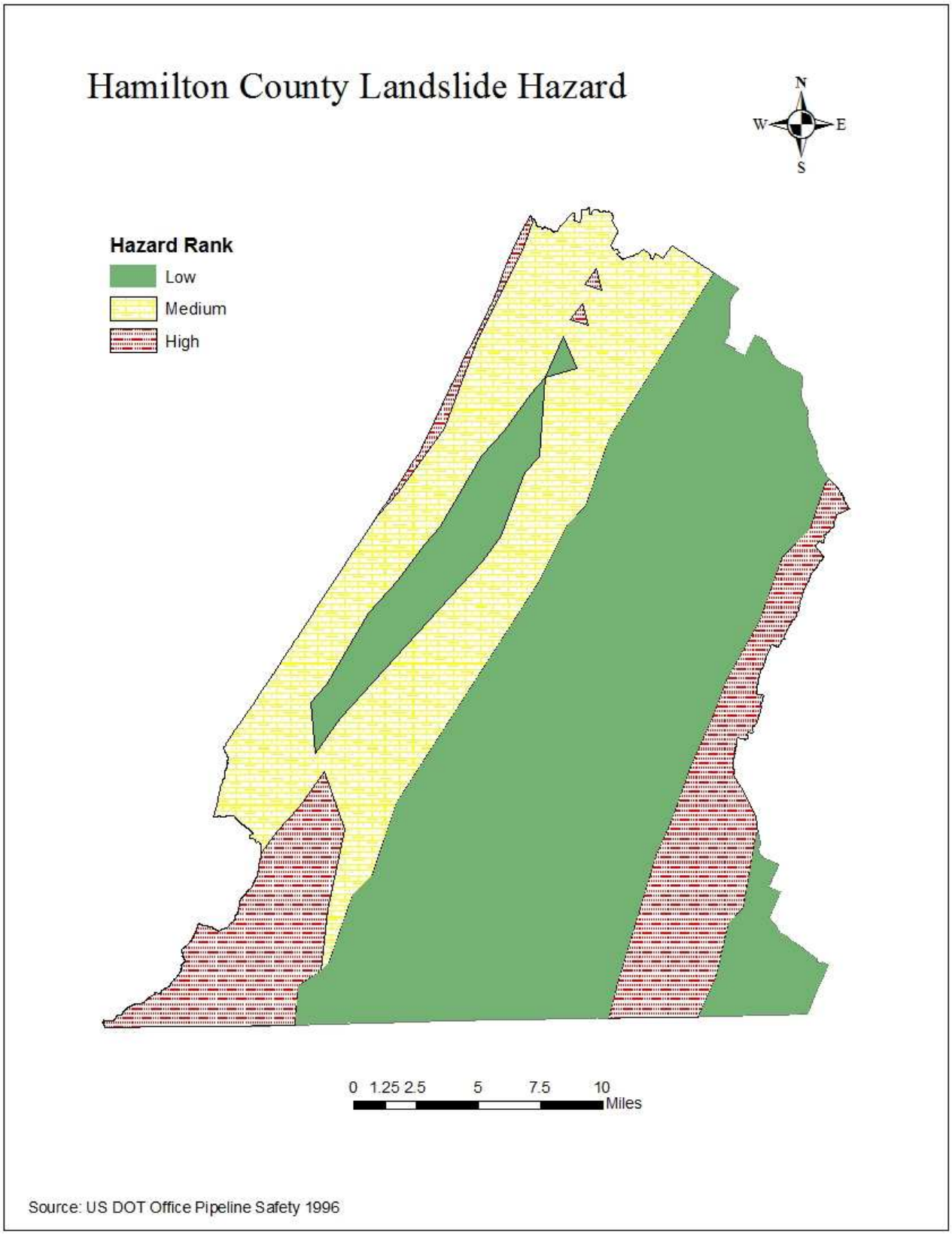
• Regional Tilting: Geologic movements can trigger weak slopes to fail.

The following map based on the Landslide Hazard Rank –LSHR dataset illustrates areas in Hamilton County that are susceptible to landslides. The map is based on an Arc/Infogrid created from information pertaining to swelling clays, landslide incidence and susceptibility and land subsidence in soils.

Each layer represents a ranking normalized to a scale of 0-100, of the level of exposure to natural hazards where 100 represents the highest ground failure hazard and zero represents

the lowest ground failure hazard.

Map 12



Streambank Erosion

All natural stream channels shift the location of their channels to some degree over time. In a channel migration hazard area, a stream is likely to move laterally which can result in property being damaged or destroyed. A house may be on a high bank above the 100-year flood elevation, yet it can still be endangered when the river erodes the ground and undercuts the bank beneath the house.

Streambank erosion has been identified as a serious problem on North Chickamauga Creek, Falling Water Creek, Rock Creek, and Big Soddy Creek. These creeks are located on highly erodible alluvial deposits consisting of a mixture of silt, sand, gravel, and cobble (a rock fragment between 64 and 256 millimeters in diameter, especially one that has been naturally rounded).

North Chickamauga Creek serves as the most striking example of the problem. The area near the Dayton Pike Bridge has been especially problematic. The U.S. Army Corps of Engineers (USACE) has documented, through analysis of aerial photography, the extent, and progress of erosion occurring above and below the bridge since 1953 (see table). The USACE study (1998) documented the following structures and areas at risk: the Dayton Pike bridge abutment and approach, two TVA transmission towers, the Soddy-Daisy Industrial Park, and several homes in the Willow Creek subdivision. Since this study was conducted, two homes in the Willow Creek subdivision have been abandoned due to undermining and the threat of imminent collapse.

Streambank Erosion on North Chickamauga Creek

Date of Aerial Photo	Extent of Erosion Upstream of the Dayton Pike Bridge (feet)	Channel Widths at Selected Locations Upstream and Downstream of the Dayton Pike Bridge (feet)			
		2000 feet above	1000 feet above	At bridge	1000 feet below
1953	500	60	190	190	150
1968	2340	120	240	240	200
1976	2550	215	260	260	220
1985	2680	160	260	260	220
1996	*	*	250	250	220

Source: USACE 1998 *no photo available

Probable causes of stream channel instability cited in the 1998 USACE study include catastrophic flooding, construction of the Dayton Pike Bridge, or past mining of cobble from the streambed.

North Chickamauga Creek, Falling Water Creek, Big Soddy Creek, and Rock Creek have been identified as area streams that are or have experienced significant channel migration due to the rapid rise and flow of water during heavy rains in conjunction with the geologic composition of stream banks and surrounding land.

Significant Events

August 17 1982
Signal Mountain Road was closed due to a mudslide.

February 16 2003
Twenty-two roads closed due to high water with mudslides on Signal Mountain

September 16-18 2003
Erosion associated with flooding from the remnants of Hurricane Ivan damaged area roads. Back Valley Road in Soddy-Daisy was washed out. Several homes in the Willow Creek subdivision lost as up to 50 feet of property as the stream bank eroded and undercut foundations. The appraised value of the homes that are now unlivable is approximately $256,000. Area road damage from floodwater erosion was estimated in excess of $500,000.

November 12, 2009
A small rockslide toppled onto the W Road on the side of Signal Mountain, closing the road.

December 12, 2009
A rockslide closed one of the two main routes up Lookout Mountain. Two large boulders came down by Scenic Highway near the Winterview condominiums. According to examining officials, two boulders fell to the road's edge but are not across the roadway.

January 28, 2012
A muddy rockslide shut down Signal Mountain's W Road, blocking one of the mountain's main thoroughfares.

Back Valley Road at Sale Creek 9/17/2004, Photograph by Amy Maxwell

Streambank erosion in Willow Creek Subdivision on North Chickamauga Creek

Mitigation efforts

Soddy Daisy received a grant from FEMA in the amount of $1,300,000 to stabilize the creek banks and re-channel over 2,000 feet of the creek. Gabion baskets were installed on the North West side of the creek (adjacent to the Willow Creek Subdivision) for 700 feet and on the northeast side of Dayton Pike Bridge adjacent to the Industrial Park for 325 feet. Total cost of project to include in-kind services is estimated to be $1,600,000.

The City also was the recipient of a USDA, NFC grant in the amount of $180,000 that was used to purchase and remove a residence that was in immediate danger of falling into the Creek.

Current Development Trends

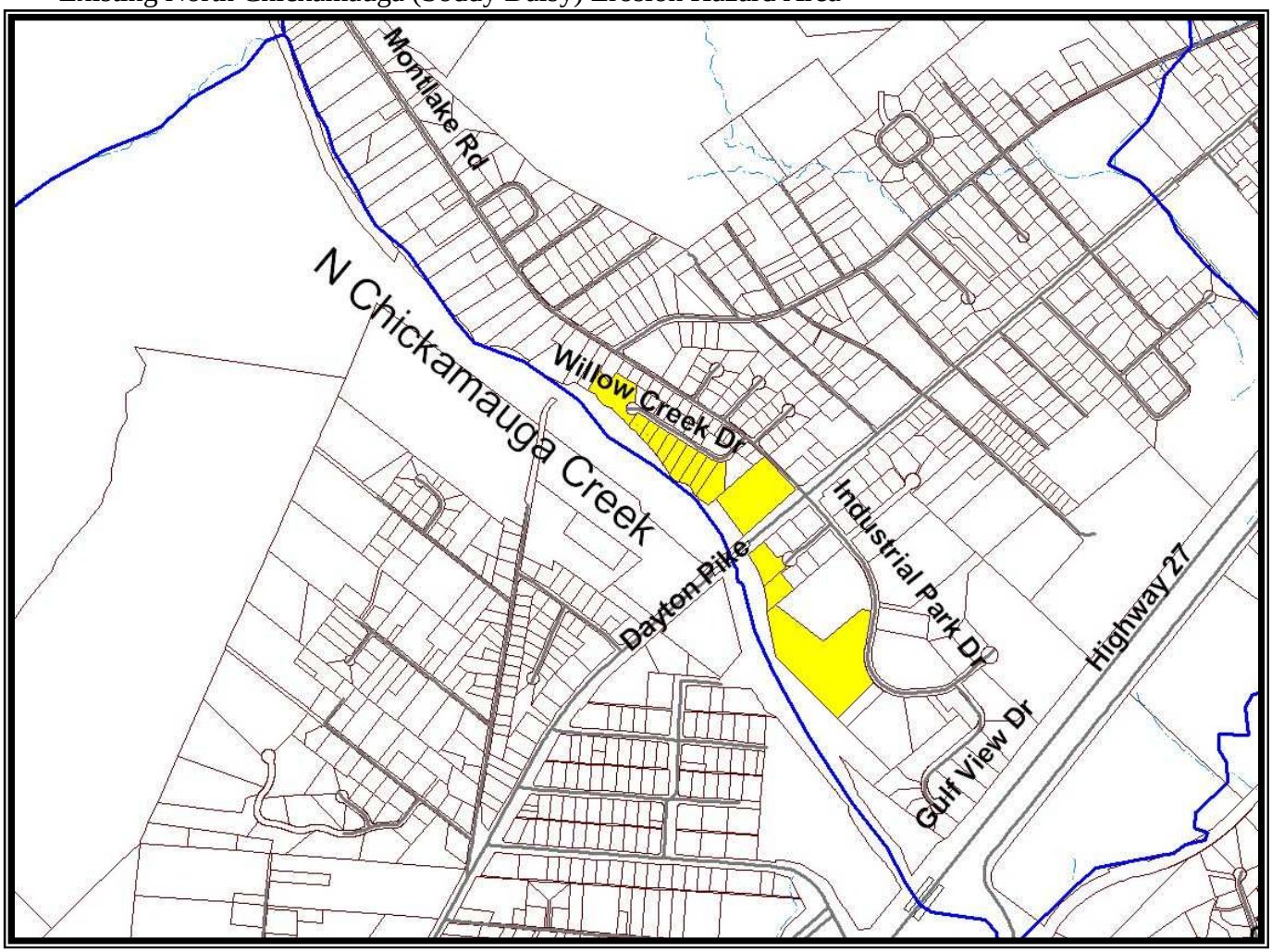
Population projections indicate growth will occur in the unincorporated portions of Hamilton County. Residential development occurring on steep slopes may increase the potential for slope destabilization and landslides. Continuing development of property along area streams with highly erodible banks will increase the number of vulnerable structures.

Vulnerability

The appraised value of vulnerable property near Dayton Pike in Soddy Daisy is 2.65 million dollars. The shaded area on Map 13 indicates property identified in the USACE 1998 study. This area has been mitigated with the use of Gabion Baskets.

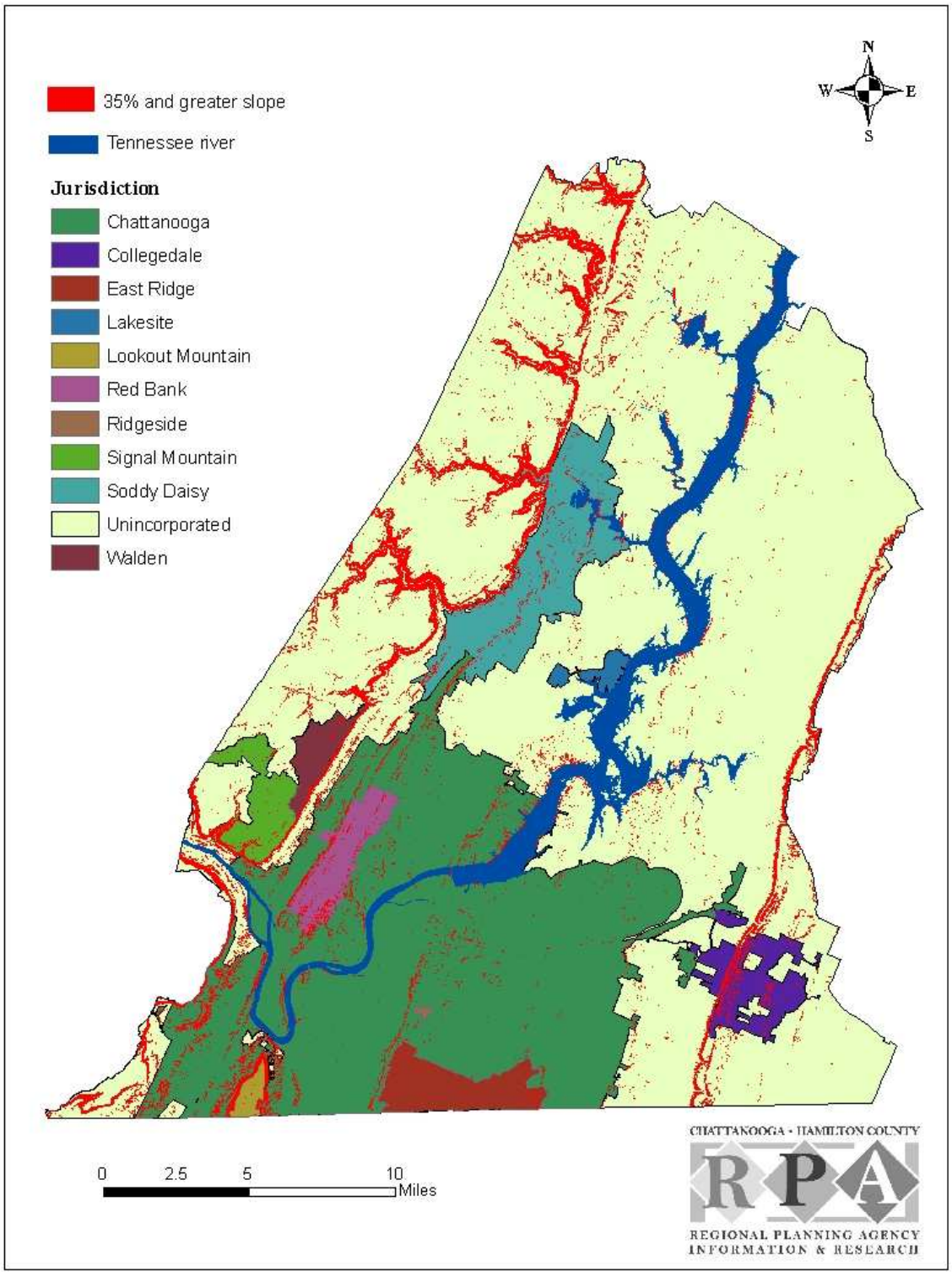
Map 13

Existing North Chickamauga (Soddy Daisy) Erosion Hazard Area



Areas of the Hamilton County with slopes of 35 percent and greater are potentially vulnerable to landslide (Map 14).

Map 14

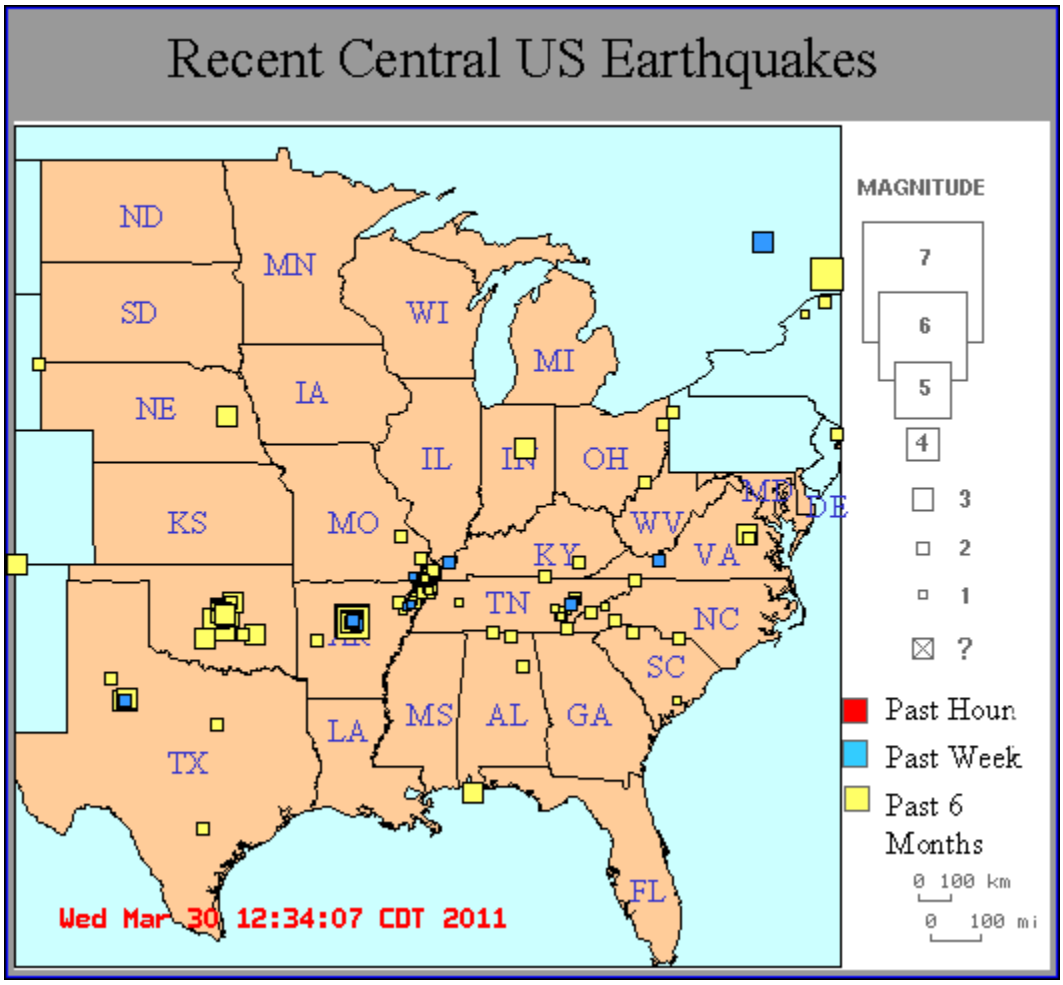

35% and greater slope
Tennessee river
Jurisdiction
Chattanooga
Collegedale
East Ridge
Lakesite
Lookout Mountain
Red Bank
Ridgeside
Signal Mountain
Soddy Daisy
Unincorporated
Walden
N
W
E
S
0
2.5
5
10
Miles
CHATTANOOGA - HAMILTON COUNTY
RPA
REGIONAL PLANNING AGENCY
INFORMATION & RESEARCH

Earthquakes

Hamilton County is in the East Tennessee Seismic Zone (ETSZ), the second most active seismic zone east of the Rocky Mountains. The greatest danger from earthquakes comes from structural failures, disruption of utilities, and falling objects. Secondary effects include fires and dam failures. In 1993, a fault zone was identified in East Tennessee running roughly parallel to Interstate 75 between Chattanooga and Bristol.

The Center for Earthquake Research and Information (CERI) at the University of Memphis, maintains a database of earthquake events in the Central United States. The following map of earthquake events within a six-month period illustrates the activity in the ETSZ.

Map 15



Significant Events

Middle Hamilton County was the epicenter for two minor earthquakes in 1998. Minor structural damage was reported as a result of these events.

April 29, 2003

A 4.9 magnitude earthquake with an epicenter located in Fort Payne, Alabama was felt in Hamilton County.

June 28, 2004
A micro earthquake occurred at 6:44:18 PM (EDT). The magnitude 2.2 event occurred five miles east of Collegedale, TN.

Mitigation efforts
There is countywide application of International Building Code 2003. Chattanooga has adopted International building code 2006.

Current Development Trends
Earthquakes are a non site-specific hazard; therefore, current development trends have no affect. However, population growth and new development increase the number of persons and property that could be impacted by an earthquake.

Vulnerability
The entire county would be affected by a major earthquake. Critical infrastructure, including Chickamauga Dam and the Sequoyah Nuclear Power Plant are of particular concern. The Tennessee Valley Authority (TVA) maintains rigorous design and inspection requirements for its facilities. TVA also regularly conducts emergency drills to prepare for such events.

Downtown Chattanooga has a large number of multistory buildings. Many of these buildings were constructed prior to the enforcement of seismic building code requirements.

The Tennessee Emergency Management Agency provided FEMA software (HAZUS) analysis to estimate the affect of a historical 5.5 magnitude earthquake with an epicenter at longitude -83.55, latitude 35.62. The following discussion summarizes the results. The full report is included in the appendix.

Overall, the HAZUS estimates a very minor impact from the earthquake. HAZUS estimates that about 39 buildings will be at least moderately damaged. No buildings will be damaged beyond repair according to HAZUS. The total economic loss estimated for the earthquake is 1.60 million dollars, which includes building and lifeline related losses.

The probability of a major earthquake is assumed to be small. However because the underlying fault lines and geology of the ETSZ are not fully understood, the potential for a major earthquake should be taken seriously.

Capability Assessment

Local departments, agencies, and organizations have a direct impact through specifically delegated responsibility to carry out mitigation activities or hazard control tasks. Chattanooga has the following government divisions that have responsibilities for hazard mitigation. These responsibilities are also carried out through departments of public works in other jurisdictions.

Chattanooga Divisions

Citywide Services are responsible for providing daily logistical planning, resource and personnel management services, and oversight of the implementation of various services. These include sewer construction and maintenance, street construction and maintenance, emergency response, solid waste and sanitation, brush collection, recycling, street cleaning and urban forestry.

Codes and Inspection is responsible for enforcing the regulatory building codes and ordinances adopted by the City. The Office of Inspection issues permits governing building, construction, electrical, plumbing, mechanical, gas and sign installation. This office is also responsible for enforcing zoning regulations.

Engineering / Storm Water / Technical Information Center is responsible for maintaining records on and overseeing city projects. Records are kept on the location of sanitary and storm sewers, right-of-ways, construction schedule, topographic and flood maps, subdivision plats, street, utility, and property information.

Waste Resources is responsible for the operation and maintenance of sanitary sewer systems and the Wastewater Treatment Plant, responds to sewer stoppages, operates the Birchwood Landfill, and the operational maintenance of storm water pumping stations at the Brainerd Levee and orchard Knob area.

Legal Authority

Enabling legislation in Tennessee delegates legal authority to local governments to implement regulatory measures. The basis for much of this authority is the police power designed to protect public health, safety, and welfare. This authority enables local officials to enact and enforce ordinances and to define and abate nuisances. As hazard mitigation is a form of protecting public health, safety, and welfare, it falls under the general regulatory powers of local governments. Enabling legislation also extends to building codes and inspections, land use, acquisition, and floodway regulation.

Building Codes and Inspections

Building codes and inspections provide local governments with the means to maintain structures that are resilient to natural hazards. The 2003 and 2006 International Building Codes, applied countywide, prescribe minimum standards for building construction that ensures structures are built to standards that have a high wind resistance and developed within flood-proofing measures. Local governments are permitted to adopt additional codes as long as the regulations are at least as stringent as the state standards. State-enabling legislation authorizes local governments to carry out building inspections to ensure local structures adhere to the minimum state building standards.

Land Use Planning
Through land use regulatory powers granted by the state, local governments can control the location, density, type and timing of land use and development in the community. The CHCRPA prepares land use plans for local jurisdictions and is currently in the process of updating the Comprehensive Plan for Hamilton County. The staff of the CHCRPA prepares recommendations on zoning cases and subdivision requests for the Chattanooga-Hamilton County Regional Planning Commission (CHCRPC).

The CHCRPC is a voluntary body of 15 members largely appointed by the Mayor of the City of Chattanooga and the County Executive for staggered three-year terms. Its role is to make zoning and land use recommendations to the local legislative bodies and to make final decisions on subdivision requests for Hamilton County and all municipal governments, except Collegedale, Red Bank, Signal Mountain, and Soddy-Daisy.

Zoning and Subdivision Regulations
Zoning and Subdivision Regulations are the two most common legal devices used to implement the policies of the Comprehensive Plan. The zoning ordinance divides jurisdictions into zones in which land use is regulated by specifying the permitted use of buildings and land, the density of development, and the size and location of buildings on the land. Local governments are authorized under the Tennessee Code Section 13 to regulate the subdivision of land within their jurisdiction. Subdivision regulates the division of land as well as the location, design, and installation of supporting infrastructure. Zoning and Subdivision Regulation provide a powerful tool for local government to direct development away from environmentally sensitive/hazardous areas such as floodplains and steep slopes.

Incorporation into existing Planning Mechanisms

Incorporation of the Plan into other planning mechanisms, by either content or reference, enhances a community's ability to perform natural hazard mitigation by expanding the scope of the Plan's influence. Over the past planning cycle, the success of incorporating Plan elements into other planning programs has varied from jurisdiction to jurisdiction. Typical ways of incorporation included:
• Use of, or reference to, Plan elements in updates to general and comprehensive planning documents.
• Addition of defined mitigation actions to capital improvement programming.
• Inclusion of Plan elements into development planning and practices.
• Resource for developing and/or updating emergency operations plans.

The Plan will continue to function as a standalone document subject to its own review and revision schedule. The Plan will also serve as a reference for other mitigation and land planning needs of the participating jurisdictions. Whenever possible, each jurisdiction will endeavor to incorporate mitigation actions and projects identified in the Plan into existing planning mechanisms and documents. This process may include adding or revising building codes, adding or changing zoning and subdivision ordinances, incorporating mitigation goals and strategies into general and/or comprehensive plans, and incorporating the risk assessment

results into development review processes to ensure proper hazard mitigation for future development.

Chapter 4 – Mitigation Strategy, Actions, and Implementation

The Federal emphasis for hazard mitigation is on reducing payouts from disaster declarations. Disaster payments are projected to increase to a point where they can no longer be sustained so it only makes sense to develop programs to bring those costs back under control. A key feature of FEMA's strategy for achieving this goal is to provide technical and financial assistance to local units of government for planning and projects to reduce overall risks to the local community. FEMA encourages local governments to use a variety of techniques to influence the location, type, intensity, design, quality, and timing of development. Many of these tools can be used to mitigate natural hazards and enhance the community's resilience and ability to recover from hazards. FEMA recommends that the following tools be used in a local mitigation strategy:

Hazard Mitigation Tools

Building standards specify how buildings are constructed. In addition to traditional building codes, building standards can include flood-proofing requirements, seismic design standards, and wind-bracing and anchoring requirements for new construction and similar requirements for retrofitting existing buildings.

Development regulations, which may include separate zoning and subdivision ordinances, regulate the location, type, and intensity of new development. Development regulations can include flood-zone regulations; setbacks from faults, steep slopes, and coastal erosion areas; and overlay zoning districts that apply additional development standards for sensitive lands, such as wetlands, dunes, and hillsides.

Capital improvement programs can be an effective way to implement mitigation throughout a community. Local public policies supporting hazard mitigation should be incorporated into these programs. Locating schools, fire stations, and other public buildings, streets, storm sewers, and other utilities outside of high hazard areas is an obvious policy. When siting public facilities in hazardous locations is necessary, communities can incorporate hazard reduction measures into the design or require retrofits where economically feasible. Public facility siting is a key determinant of the location of new privately financed growth in a community. As such, facilities, particularly roads and utilities, should not be sited where they have the potential to encourage growth in high hazard zones.

Land and property acquisition means purchasing properties in hazard-prone areas with public funds, and restricting development to uses that are less vulnerable to disaster-related damages. This can be accomplished through acquisition of undeveloped lands, acquisition of development rights, transfer of development rights to lower-risk areas, relocation of buildings, and acquisition of damaged buildings.

Taxation and fiscal policies can be used to distribute the public costs of private development of high hazard areas more equitably, specifically shifting more of the cost burden directly onto owners of such properties. Employing impact taxes to cover the public costs of development in areas of high hazards or providing tax breaks for reducing land use intensities in hazardous areas are two options.

Public awareness through information dissemination on natural hazards, and providing educational materials to the construction industry, homeowners, tenants, and businesses are also important. Included in this category are hazard disclosure requirements for the real estate industry and public information campaigns to increase awareness in all sectors of the community.

Implementation of National Flood Insurance Program (NFIP)

The National Flood Insurance Program (NFIP) is a federal program to identify flood prone areas and make flood insurance available to the owners and leasers of property. This insurance provides an insurance alternative to disaster assistance for meeting escalating costs of repairing damaged buildings and their contents from floods. Participation in the NFIP by Hamilton County, Chattanooga, Collegedale, East Ridge, Lookout Mountain, Red Bank, Signal Mountain, and Soddy Daisy is by agreement with the federal government predicated on the adoption and enforcement of floodplain ordinances that ensure new buildings will be free from flood damage and prevent new developments from increasing flood damages on existing properties.

There are currently 2,627 flood insurance policies in effect in Hamilton County.
The county and participating jurisdictions currently do not participate in the Community Rating System, but enrollment in the program as a long-term priority. The Town of Walden has been informed about the NFIP program but has decided not to participate at this current time largely because they are situated on elevated land that diminishes their chances of receiving a major flood.

National Flood Insurance Program			
	Community Number	Policies	Insurance in force
Hamilton County	470071	268	$57,558,600
Chattanooga	470072	1530	$328,112,000
Collegedale	475422	20	$5,062,300
East Ridge	475424	442	$63,953,300
Lookout Mountain	470075	1	$250,000
Red Bank	470076	131	$19,735,400
Signal Mountain	470078	3	$1,050,000
Soddy Daisy	475445	232	$34,110,600
Total		2,627	$509,832,200
Source: http://bsa.nfipstat.com/reports/1011.htm#TNT			

In October of 2009, NFIP communities in Hamilton County began a Flood Map Project with FEMA to update local flood maps through the Risk Map (Risk Mapping, Assessment, and Planning). New studies under Risk Map are based on need. Local communities have the responsibility to identify needs and priorities. Risk Map creates a partnership between FEMA and local communities to address local needs.

The goals of the program are to:

- Address gaps in flood hazard data
- Increase public awareness and understanding of risk
- Assist and support local entities engaging in risk-based mitigation planning

- Provide an enhanced digital platform
- Align Risk Analysis programs and develop synergies

Plan Goals

Flood:
Protect lives and property by reducing the occurrence and severity of flood events in Hamilton County.

Severe Storms:
Reduce potential damages to new and existing buildings and infrastructure and increase public preparedness.

Tornadoes:
Save lives, reduce property damage, and increase awareness of the danger of tornadoes.

Landslide/Erosion:
Identify high hazard areas and identify techniques to minimize risk.

Drought/Wildfire:
Increase public awareness and educate property owners in techniques to reduce the threat of wildfires to property.

Earthquakes:
Save lives, reduce potential property damage and increase public awareness.

Objectives and Actions

Each participating jurisdiction has developed and prioritized objectives and preferred actions to mitigate natural hazards in its locality. Objectives represent measurable steps towards achievement of overall plan goals. Preferred actions are specific measures implemented to achieve the objectives of the plan. Preferred actions are prioritized at the jurisdiction level. Mitigation action priority is based on the local government capability, likelihood of implementation, and qualitative discussion of costs and benefits. The achievement of objectives and implementation of specific actions in some instances may be contingent upon the future availability of local, state, and federal resources and funding.

Plan Update Statement: Mitigation goals remain the same. Mitigation actions for each jurisdiction have been updated to reflect items that have been completed, are deferred, or have been deleted. Mitigation actions addressing fog have been removed.
The University of Tennessee at Chattanooga and the Hamilton County Department of Education are new plan participants.

Process for Setting Priorities for Mitigation Measures
The decisions on mitigation action priorities were made by each plan participant. Priority setting was based on local knowledge of the hazard areas, including impacts of hazard events and the extent of the area impacted and the relation of a given mitigation measure to the jurisdiction's identified goals. In addition, each jurisdiction took into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether the jurisdiction currently had the technical and administrative capability to carry out the mitigation measures, whether any environmental constraints existed, and whether the jurisdiction would be able to justify the costs relative to the anticipated benefits.
The listing of high, medium, and low priority for potential mitigation measures is provided for each mitigation action.

Mitigation Actions

Countywide

1. *Installation of early warning system (Reverse 911) to notify residents of imminent danger*

Responsible Agency: Hamilton County Office of Emergency Services
Priority: High
Cost Estimate: $25,000
Benefit: Ability to target specific areas countywide for notification of imminent danger from all hazards.
Potential funding source: Hamilton County EMS has acquired a grant to fund startup of this project: maintenance of the system will be funded locally from existing budgets.
Schedule: Action Completed for landline, ongoing registration for cell phone, VOIP, and e-mail
Status: Completed**:** A reverse notification system to contact all landlines in the county was completed in 2005. County Emergency Services expanded the capabilities of the notification system in 2009 to contact cell phone, e-mail, and VOIP.

2. *Increase and reinforce public awareness of natural hazards including information on preparedness.*

Responsible Agency: Hamilton County Office of Emergency Services in coordination with local media outlets

Priority: High
Cost Estimate: Existing staff and local resources
Benefit: Low cost and significant benefit in culturing an informed and prepared citizenry
Potential funding source: Existing budget
Schedule: Continuous and timely to address seasonal weather hazards. Yearly to address low probability hazards such as earthquakes.
Status: This action continues.

3. *Locate all new essential and emergency service facilities outside of flood hazard areas.*

Responsible Agency: Hamilton County/Jurisdiction Administrations
Priority: High
Cost Estimate: NA
Benefit: Protects new emergency service facilities (critical infrastructure) from known flood hazards.
Potential funding source: Existing local budget
Schedule: Continuous as needed
Status: Ongoing: This action continues.

4. *Appoint one person as the hazard mitigation planner/coordinator for Hamilton County and Jurisdictions*

Responsible Agency: Hamilton County/Jurisdictions
Priority: High
Cost Estimate: to be determined
Benefit: It is more cost effective and efficient to have a proactive mitigation planner/coordinator rather than local reactionary response to state and federal opportunities and planning requirements. This position would be able to facilitate the mitigation planning process, work with local jurisdictions to strengthen hazard risk and vulnerability assessment, assist local jurisdictions with development of mitigation alternatives and actions, assist with the identification of funding resources, conduct cost benefit analysis of mitigation alternatives, and coordinate and write grant applications.

Potential funding source: Existing local budget
Schedule: Complete
Status: Completed: Hamilton County Emergency Management has added two planners to its staff

5. *Evaluate structural vulnerability of pre- seismic construction standards buildings to earthquake; continue enforcement of seismic standards for new construction.*

Responsible Agency: Hamilton County/Jurisdiction Building Code Enforcement
Priority: Medium
Cost Estimate: Existing staff and local resources
Benefit: Information to prioritize structures for seismic retrofit, protect lives and property
Potential funding source: Existing local budget

Schedule: Continuous as local resources allow
Status: This action will continue

Chattanooga

Objectives

1. Continually review existing ordinances and/or create ordinances to support mitigation plan goals.
2. Increase the capability to monitor rainfall and stream flow.
3. Increase basin modeling and flood mapping capabilities.
4. Protect area streams from the effects of urban development.
5. Decrease the number of repetitive loss structures.
6. Increase scrutiny of proposed developments and monitor development in floodplains and floodways.
7. Reduce flooding of the Rossville Boulevard commercial district.
8. Increase capabilities to warn flood zone residents of imminent flooding due to headwater rainfall.
9. Reduce the impact of power outages on crucial infrastructure.
10. Upgrade inadequate infrastructure.

Preferred Actions

1. *Review and revise ordinances necessary to strengthen mitigation efforts.*

Responsible Agency: CHCRPA, Public Works: Division of Codes and Inspection, Engineering/Stormwater
Priority: High
Cost Estimate: Three months of staff time
Benefit: Reduce vulnerability, encourage responsible and sustainable development
Potential funding source: Existing budget
Schedule: Continuous
Status: Chattanooga has updated its zoning ordinance to reflect changes to coincide with recommendations from the State of Tennessee planning office, and FEMA. The relevant section of the zoning ordinance is located in the appendix.

2. Establish requirements for stream buffers.
Responsible Agency: Public Works: Stormwater Management
Priority: High
Cost Estimate: Six months of staff time
Benefit: Improve regulatory authority, reduce vulnerability, improve water quality, decrease rate and volume of rainfall runoff.
Potential funding source: Existing budget
Schedule: within one year (2013)
Status: Deferred**:** Efforts are continuing

3. Increase scrutiny of proposed developments and monitor development in floodplains and floodways.

Responsible Agency: Public Works: Land Development Office, Zoning, Stormwater Management
Priority: High
Cost Estimate: Six months of staff time
Benefit: Increase ability to guide responsible development in sensitive areas**.** Improve public information
Potential funding source: Existing budget
Schedule: Continuous
Status: All personnel in the City of Chattanooga, Land Development Office, Zoning Division, have attended training in Managing Floodplain Development at the FEMA national training center in Emmitsburg, Maryland. All plans submitted for development in the floodplain are reviewed by these trained personnel. This includes both commercial and residential. This department also maintains the elevation certificates and other data, such as LOMR-F's (**Letter of Map Revision Based on Fill**) to comply with NFIP requirements and also to be readily able to provide this information to the public, insurance companies, and banking institutions. Additionally, new LOMR-F's and other map revisions are reported to the GIS department to assure that these changes are available on the official mapping of the City of Chattanooga. This information is then available on-line, free of charge.

4. Implement flood control measures for Dobbs Branch Watershed

Responsible Agency: Public Works: Engineering/Stormwater
Priority: High
Cost Estimate: Based on feasibility study
Benefit: Reduce impact of repeated flooding in the area
Potential funding source: USACE, Existing budget
Schedule: Within 5 years (2013)
Status: Chattanooga will continue efforts to complete this action.

5. Installation of additional stream flow gauges in N. Chickamauga, Chattanooga, Lookout, Mountain, and Citico Creeks.

Responsible Agency: Public Works: Stormwater Management, Hamilton County EMA
Priority: Medium
Cost Estimate: $13,850 per gauge
Benefit: Improve prediction capabilities, increase warning time, and reduce loss of property and life
Potential funding source: Local, USGS
Schedule: 2013
Status: Chattanooga will continue efforts to complete this action.
Hamilton County Emergency Management, USGS, National Weather Service (Morristown), and local jurisdictions (including Walker and Catoosa counties in North Georgia) have formed *TennGa Hydrowatch.* The partnership plans to seek funding for a flow/stage/rain gauge on Chattanooga Creek in fiscal year 2011.

6. Implement automatic notification from rain gauges and flow meters to Stormwater Management staff.

Responsible Agency: Public Works: Stormwater Management
Priority: Medium
Cost Estimate: $150,000
Benefit: Improve prediction capabilities, increase warning time, and reduce loss of property and life
Potential funding source: Existing budget
Schedule: within 5 years (2016)
Status: Chattanooga will continue efforts to complete this action.

7. *Continue development of basin modeling and creation of flood mapping in developing areas.*

Responsible Agency: Public Works: Stormwater Management
Priority: Medium
Cost Estimate: $1,500 per river mile for approximate A zone studies; $15,000 per river mile for detailed studies
Benefit: Improve land use planning and regulation, reduce vulnerability of new development
Potential funding source: USACE, existing budget
Schedule: within 5 years (up to 10 years) (2016-2021)
Status: Chattanooga will continue efforts to complete this action.

8. *Decrease the number of repetitive loss structures*

Responsible Agency: Public Works: Engineering/Stormwater
Priority: Medium
Cost Estimate: $5,000,000
Benefit: Relocation/Removal is more cost effective than repeated losses
Potential funding source: PDM, HMGP, FMA
Schedule: Continuing
Status: In the last five-year period the City of Chattanooga, Land Development Office applied for and received a grant for Hazard Mitigation of repetitive loss structures. Seven homes were purchased and the land returned to open green space. We will continue to seek funding when available to continue this process. Also, building applications, are reviewed for previously flood damaged properties, or applicants seeking additions to structures in the floodplain before allowing substantial repair or improvement to properties without proper mitigation measures.

9. *Improve GIS capabilities to include real-time modeling and better projections of flood areas.*

Responsible Agency: Public Works: Engineering/Stormwater
Priority: Medium
Cost Estimate: Existing staff
Benefit: Improve warning of flood potential, improve land use planning and regulation, avoid development of flood prone areas
Potential funding source: USACE, PDM, existing budget

Schedule: within 5 years (2016)
Status: Chattanooga will continue efforts to complete this action.

10. Mountain Creek flood zone restoration.

Responsible Agency: Public Works: Engineering/Stormwater
Priority: Low
Cost Estimate: $500,000
Benefit: Flood protection, improved water quality
Potential funding source: TDEC Mitigation Banking
Schedule: Within 5 years (2016)
Status: Chattanooga will continue efforts to complete this action.

11. Citico Creek WPA channel removal and natural stream restoration.

Responsible Agency: Public Works: Engineering/Stormwater
Priority: Low
Cost Estimate: Based on feasibility study
Benefit: Improved flood control, improved water quality
Potential funding source: PDM, HMGP, USACE, NRCS
Schedule: 5 years plus (2016+)
Status: Chattanooga will continue efforts to complete this action.

12. Reduce impact of power outages on crucial infrastructure

Responsible Agency: Waste Resources/Public Works
Priority: Low
Cost Estimate: Based on site specific needs assessment
Benefit: water quality improvement, flood protection
Potential funding source: existing budgets
Schedule: 5 years plus (2016+)
Status: The Waste Resources Division of the Public Works Department has met with the Electric Power Board and where possible identified multiple sources of power feeds for their large sewage pump stations. Seven (7) of the smaller stations have on-site generators and automatic transfer switches. Five (5) of the CSO facilities have on-site generators. They are planning to add more generators as funds permit to pump stations in the near future. The Moccasin Bend Treatment Plant has two distinct electrical feeds available at the plant switchyard. The control center for the treatment plant has a back up generator and automatic transfer switch. They have three portable generators available for use, capable of operating the smaller stations, with an SOP in place for deployment. These stations are equipped with generator connections and transfer switches.

The Paul Clark Building, the dispatch center for brush, trash, and street clearing crews also has an on site generator.

13. Acquire property for greenway system.

Responsible Agency: Trust for Public Land, Parks and Recreation, Public Works: Engineering
Priority: Low
Cost Estimate: 2.65 million for the current South Chickamauga extension
Benefit: Flood protection, Stormwater Management, utilize potential flood hazard areas for public recreation
Funding source: 1.6 million in federal transportation funds for alternative transportation, 400,000 federal stimulus funds, 400,000 from the Lyndhurst foundation, and 250,000 from the Benwood Foundation
Schedule: Continuous as funding becomes available
Status: Work has begun on a new 3 to 4 mile section of Greenway from a paved portion of the South Chickamauga Creek greenway off Amnicola Highway heading towards the current Brainerd levee terminus of the greenway at Shallowford Road.

Collegedale

Objectives

1. Maintain flow capacity at the Wolftever Creek/Tallant Road bridge.
2. Reduce flooding on Apison Pike at Wolftever Creek.

Preferred Actions

1. *Routinely clean debris from support bracings under bridges.*

Responsible Agency: Public Works
Priority: High
Cost Estimate: Existing staff
Benefit: Reduce backup flooding on Apison Pike and Tallant Road
Potential funding source: Existing budget
Schedule: Continuous
Status: Ongoing cleanup of debris has mitigated flooding on Apison Pike and Tallant Road

2. *Raise State Route 317 at McKee Plant #2 to alleviate roadway flooding.*

Responsible Agency: Public Works, TDOT
Priority: Medium
Cost Estimate: Based on feasibility study
Benefit: Eliminate chronic flooding problem on State Route 317
Potential funding source: TDOT, existing budget
Schedule: Project completion date = 2015
Status: Updated schedule to align with TDOT timeline

East Ridge

Objectives

1. Reduce flood damage in the Spring Creek and South and West Chickamauga Creek flood zones.
2. Reduce the amount of property damage due to both stream bank erosion and outdated stormwater management systems during flash flooding and/or flood events.
3. Increase early warning and accurate flood level assessment tools for better awareness and emergency preparedness.
4. Improve water quality and general management of the City's stormwater management system by treating the 1st ½ inch of rain water during storm events.

Preferred Actions

1. *Acquire funds to flood proof (via in-place elevation) or purchase existing repetitive loss structures in the floodplain and clear the land to be held as open space*

Responsible Agency: City Services and Codes Enforcement
Priority: High
Cost Estimate: Based on feasibility study
Benefit: Mitigation of repetitive loss structures is more cost effective than no action
Potential funding source: FMA, PDM
Schedule: Continuous as funding becomes available

2. *Evaluate alternatives to do the following (A.) reduce rate and volume of rainfall runoff into area creeks to reduce flooding potential; and (B.) reduce amount of property damage due to outdated stormwater management system during all large flood events.*

Responsible Agency: City Services, CHCRPA and Building Official
Priority: High
Cost Estimate: Existing staff
Benefit: Flood control, storm water management, improve water quality
Potential funding source: PDM, existing budget
Schedule: 1 year (2012)

3. *Redirect or intercept the high flow of Spring Creek at the Anderson Avenue outlet and divert into South Chickamauga Creek.*

Responsible Agency: City Services and Building Official
Priority: Medium
Cost Estimate: Based on feasibility study
Benefit: Flood control, stormwater management
Potential funding source: PDM, HMGP, USACE, existing budget
Schedule: Within 5 years (2015)

4. *Improve current stormwater infrastructure to handle 2, 5, and 10-year events while minimizing erosion (especially along the John Ross/Bennett/Laredo and Marlboro Drainage System).*

Responsible Agency: City Services and Building Official
Priority: High
Cost Estimate: Based on feasibility study
Benefit: Flood control, stormwater management, improve water quality
Potential funding source: PDM, HMGP, USACE, existing budget
Schedule: 5 years plus (2016+)

5. *Add water level gauging tools to include monitoring and software in Spring Creek to provide accurate flood level measurements.*
Agency: Codes Enforcement and NOAA
Priority: High
Cost Estimate: Based on feasibility Study
Benefit: Accurate warning of flood events
Potential Funding source: NOAA/East Ridge/FEMA/Various grants
Schedule: Within 1 year (2012)

6. *Dredge or clean-out excess debris and silt portions of Spring Creek and Chickamauga Creek.*
Agency: Corp of Engineers and TDEC.
Priority: High
Cost Estimate: Based on feasibility study
Benefit: Allow decrease property damage during floods
Funding source: TBD
Schedule: Within 5 years (2016)

7. *Create a City initiative to produce an ongoing public education marketing campaign advising homeowners and businesses about floods and encouraging them to obtain flood insurance.*
Agency: City Manager's Office and Building Official
Priority: Medium
Cost Estimate: Based on marketing materials
Benefit: Inform the public about floods and available flood insurance.
Funding source: TBD
Schedule: Ongoing

8. *Review/revisions of local building codes (improve structural ability to withstand high winds/snow load earthquakes.)*
Agency: Building Official
Priority: Low
Cost Estimate: TBD
Benefit: Allow decrease property damage during earthquakes
Funding source: TBD
Schedule: Within 5 years (2016)

9. *Create a comprehensive stormwater management plan*
Agency: City Manager's Office, TDEC and Building Official
Priority: High
Cost: TBD

Benefit: To assist in evaluating the City's stormwater system and develop/implement various alternatives to update the current stormwater management system to prevent flooding of new and existing buildings and infrastructure.
Funding Source: TEMA, TDEC, and City of East Ridge
Schedule: Within 2 years (2013)

Lookout Mountain:

Objectives

1. Increase the capability to mitigate the effects of drought, wildfire, ~~fog~~, and severe weather events.
2. Increase the capacity to support vulnerable population in the event of natural disasters and /or utility service disruption

Preferred Actions

1. Acquire backup source of electricity for water pumps to supply storage tanks.

Responsible Agency: Public Works
Priority: High
Cost Estimate: Based on feasibility study
Benefit: Maintain supply of water during power outages
Potential funding source: HGMP, existing budget
Schedule: Continuing maintenance of generators
Status: Completed/Ongoing maintenance: A backup source of electricity is in place for water pumps supplying water to the two storage tanks at Fort Circle on Lookout Mountain. A diesel generator is installed at the pump station to be placed in use in case of power outages. A second backup system can be placed in service within 24 hours. The large tanks capacity is 1.2 million gallons and the small tank has a capacity of 475,000 gallons. The Towns's water system is owned and operated by the Tennessee American Water Company. The company plans to begin construction of a larger supply line up the eastern bluffs below East Brow Rd. in January 2010.

2. Identify vulnerable population and establish procedures and locations for emergency shelter in the event of natural disaster and/or utility service disruption.

Responsible Agency: Hamilton County Office of Emergency Services, Town of Lookout Mountain
Priority: High
Cost Estimate: Existing staff time
Benefit: Increase capacity, utilization, and coordination of local resources in support of vulnerable population, protect health and safety of local residents.
Potential funding source: PDM, existing budget
Schedule: Continuous

Status: Completed/Ongoing: The Fire and Police Department currently has a list and access keys of elderly residents that enables the Town to maintain contact with them for health reasons. The department is called upon by these residents to give assistance periodically. The Town Commission will establish a written procedure to provide this emergency shelter by February 1, 2010. Research has revealed that only one location exists that can provide a diesel electric power generator in the event of a power outage and this is Lookout Mountain Elementary School. The agreement between the Town and the Hamilton County Board of Education is located in the appendix

3. Establish a fireplug and hose drop for wildfire suppression on the mountainside.

Responsible Agency: Town Fire Department
Priority: Medium
Cost Estimate: Based on feasibility study
Benefit: Enhance ability to quickly control and suppress wildfire on steep forested slopes.
Potential funding source: HGMP, existing budget
Schedule: Completed
Status: Completed: Fireplugs are located on each block of East Brow and West Brow Roads. The apparatus and personnel responding to the scene by the Lookout Mountain Fire Department will supply a Hose Drop and Perimeter control. Backup Hose Drop will be supplied by the Lookout Mountain Georgia fire Department.

4. Coordinate wildfire control on steep slopes with the City of Chattanooga, the National Park Service, the Tennessee Division of Forestry, and the Town Fire Department.

Responsible Agency: Town Fire Department, Hamilton County Office of Emergency Services
Priority: Medium
Cost Estimate: Existing staff
Benefit: Enhance interagency coordination and response to wildfire on steep forested slopes.
Potential funding source: PDM, existing budget
Schedule: Continuous
Status: In the event of mountainside wildfire, Hamilton County Emergency Services, Tennessee Division of Forestry, the National Park Service, city of Chattanooga, Town of Lookout Mountain Tennessee Fire Department, Lookout Mountain Georgia Fire Department, and Tri-State Mutual Aid will utilize a combined agency effort. All contact numbers are on file at Lookout Mountain Tennessee Fire/Police Dispatch.

5. Acquire warning signs for area roads to warn of fog conditions

Responsible Agency: To be determined, TDOT
Priority: Low
Cost Estimate: Based on feasibility study
Benefit: Prevent traffic accidents

Potential funding source: TDOT, existing budget
Schedule: Within 5 years (2010)
Status: Deleted: The Lookout Mountain hazard mitigation committee recommends that fog-warning signs are not necessary. The Town strives to warn residents of fog conditions and other hazardous road conditions by use of the Town's website www.lookoutmountaintn.org

6. *Provide for Medical and subsistence needs if periods of extended blockage of state highway access to Lookout Mountain is caused by land or rock slides.*

Responsible Agency: Town of Lookout Mountain, CARTA
Priority: High
Cost Estimate: NA
Benefit: Maintain freedom of movement of services, persons, and supplies in the event of extended road closure.
Potential funding source: TDOT, existing budget
Schedule: Complete
Status: Completed: An agreement has been established between the Town of Lookout Mountain and the Chattanooga Area Regional Transportation Authority to utilize the service of the Lookout Mountain Incline for medical and subsistence needs. The agreement between the Town and CARTA is located in the appendix

Red Bank

Objective

1. Reduce flood damage associated with Stringers Branch and tributaries

Preferred Action

1. *Buy out or mitigate via in place elevation repetitive loss properties*

Responsible Agency: Public Works: Administration and Engineering
Priority: High
Cost Estimate: Based on feasibility study
Benefit: Eliminate repetitive cost of flood damage to existing buildings
Potential funding source: FMA, existing budget
Schedule: Continuous as funding becomes available
Status: Deferred: Red Bank will continue to pursue this preferred action as resources allow.

Signal Mountain:

Objectives

1. Reduce the occurrence of power and communication outages, and traffic disruptions due to severe winds. (Due to fallen trees and utility lines.)
2. Reduce the occurrence of mudslides and erosion.
3. Increase the capacity to support vulnerable population in the event of natural disasters and /or utility service disruption.

Preferred Actions

1. *Evaluate the feasibility of underground utilities, scheduled tree trimming and removal of dead trees in ROW.*

Responsible Agency: Individual Utility Companies, Town of Signal Mountain
Priority: High
Cost Estimate: Based on feasibility study
Benefit: Eliminate the cost of repetitive repair of new utility infrastructure and traffic disruptions caused by frequent weather related events.
Potential funding source: PDM, HGMP, utility companies, existing budget
Schedule: Within 2 years (2013)
Status: Deferred: Signal Mountain has chosen to continue efforts to complete this action.

2. *Identify vulnerable population and establish procedures and locations for emergency shelter in the event of natural disaster and/or utility service disruption.*
   Example: Alexian Village and campus

Responsible Agency: Hamilton County Office of Emergency Services, Town of Signal Mountain
Priority: High
Cost Estimate: Existing staff time
Benefit: Increase capacity, utilization, and coordination of local resources in support of vulnerable population, protect health and safety of local residents.
Potential funding source: PDM, existing budget
Schedule: Within 2 years (2013)
Status: Deferred: Signal Mountain has chosen to continue efforts to complete this action.

3. *Identify and map areas susceptible to landslide and erosion.*

Responsible Agency: Stormwater Utility, Hamilton County GIS, NRCS
Priority: Medium
Cost Estimate: Existing staff
Benefit: Identify hazard for existing and future development
Potential funding source: PDM, existing budget
Schedule: Within 5 years (2016)
Status: Deferred: Signal Mountain has chosen to continue efforts to complete this action.

4. *Evaluate need for warning signs for area roads to warn of fog conditions.*

Responsible Agency: To be determined, TDOT
Priority: Low
Cost Estimate: Based on feasibility study
Benefit: Prevent traffic accidents
Potential funding source: TDOT, existing budget
Schedule: Within 5 years (2016)
Status: Deleted: The National Weather Service and local media issue fog warnings to alert motorists of hazardous driving conditions. A review of past five years shows that it has not been a problem in the past that warrants further action.

Soddy-Daisy

Objectives:

1. Reduce and mitigate erosion
2. Mitigate repetitive loss properties
3. Mitigate areas that flood

1. **Little Soddy Creek (from Masonic Lodge to Soddy Embayment)**
   Restore shoreline to stop erosion, clean out and re-channel to improve capacity due to buildup of silt and debris

   Responsible Agency: TDEC, TVA, Army of Corps of Engineers, City of Soddy-Daisy
   Priority - High
   Cost Estimate - Based on feasibility study
   Benefit - To stop erosion of present roadway that is in immediate danger of being washed away, reduce possibility of flooding new and existing buildings and infrastructure, and to reduce the possibility of flooding of business district.
   Potential Funding Source - FEMA, Federal and State Mitigation funds, and local taxes
   Status: New action

2. **Soddy Lake Embayment**
   Dredge excessive siltation from storm or heavy rain runoff, remove garbage, trees and brush

   Responsible Agency - TVA, TDEC, City of Soddy-Daisy
   Priority - High
   Cost Estimate - Based on feasability and engineering studies
   Benefit - To eliminate continued flooding of business district due to silting and debris which impedes effluent from Little Soddy Creek
   Potential Funding Source - FEMA, Federal and State Mitigation funds, and local taxes
   Status: New action

3. **Poe Branch**

Clean out garbage and brush to alleviate flooding of Daisy Dallas Road, distance being from Bean Street to Harrison Lane

Responsibility Agency - TDEC and the City of Soddy-Daisy,
Priority - High
Cost Estimate - Existing Staff
Benefit - To alleviate flooding of Daisy Dallas Road and new and existing buildings and infrastructure around Pottery
Lane, Church Street and Kingsboro Street
Potential Funding Source - Existing local budget
Status: New action

4. **Big Soddy Creek**

Re-channel and dredge Creek west of Dayton Pike

Responsible Agency - TDEC, TVA, Army Corps of Engineers, City of Soddy-Daisy
Priority - High
Cost Estimate - Based on engineering design and study
Benefit - To protect two bridges and roadway that are in immediate danger of being washed away and to alleviate flooding upstream.
Potential Funding Source - FEMA, Federal and State Mitigation funds, and local taxes
Status: New action

5. **Big Soddy Creek**

Seek grant to purchase residential structure

Responsible Agency - FEMA, TDEC, Army Corps of Engineers, City of Soddy-Daisy
Priority - Medium
Cost Estimate - $150,000 to $200,000
Benefit - Stabilization of the shoreline or embankment would be more costly than the purchase of the residence.
Potential Funding Source - FEMA, Federal and State Mitigation funds, and local taxes
Status: New action

6. **North Chickamauga Creek**

Seek grant to purchase residential structure

Responsible Agency - FEMA, TDEC, Army Corps of Engineers, City of Soddy-Daisy
Priority - High
Cost Estimate - $150,000 to $200,000

Benefit - Stabilization of the shoreline or embankment would be more costly than the purchase of the residence.
Potential Funding Source - FEMA, Federal and State Mitigation funds, and local taxes
Status: New action

Soddy-Daisy - Completed Actions

Objectives

1. Protect stream banks from erosion; minimize future damage to North Chickamauga Creek banks and bridges.

The City received a grant from FEMA in the amount of $1,300,000 to stabilize the creek banks and re-channel over 2,000 feet of the creek. Gabion baskets were installed on the North West side of the creek (adjacent to the Willow Creek Subdivision) for 700 feet and on the northeast side of Dayton Pike bridge adjacent to the Industrial Park for 325 feet. Total cost of project to include in-kind services is estimated to be $1,600,000.

The City also was the recipient of a USDA, NFC grant in the amount of $180,000 that was used to purchase and remove a residence that was in immediate danger of falling into the Creek.

Continuation of bank stabilization is needed and the re-channeling of the creek bed for approximately 2,000 feet on both side of the stream bank using gabian baskets and natural plantings.

Walden

Objectives

1. Reduce the occurrence of power and communication outages.
2. Increase the capacity to support vulnerable population in the event of natural disasters and /or utility service disruption.
3. Reduce the occurrence of mudslides and erosion.

Preferred Actions

1. *Evaluate the feasibility of underground utilities*

Responsible Agency: To be determined, EPB, South Central Bell
Priority: High
Cost Estimate: Based on feasibility study

Benefit: Eliminate the cost of repetitive repair to new and existing utility infrastructure caused by frequent weather related events.
Potential funding source: PDM, HGMP, EPB, South Central Bell existing budget
Schedule: based on feasibility study
Status: Deferred: Walden has chosen to continue efforts to complete this action.

2. *Identify vulnerable population and establish procedures and locations for emergency shelter in the event of natural disaster and/or utility service disruption.*

Responsible Agency: Hamilton County Office of Emergency Services, Town of Walden
Priority: High
Cost Estimate: Existing staff time
Benefit: Increase capacity, utilization, and coordination of local resources in support of vulnerable population, protect health and safety of local residents.
Potential funding source: PDM, existing budget
Schedule: Within 2 years (2013)
Status: Deferred: Walden has chosen to continue efforts to complete this action.

3. *Identify and map areas susceptible to erosion/landslide.*

Responsible Agency: Hamilton County GIS, NRCS, CHCRPA
Priority: Medium
Cost Estimate: Existing staff
Benefit: Avoid development of new buildings and infrastructure in hazardous areas; notify residents in potentially hazardous areas
Potential funding source: Existing budget
Schedule: Within 2 years (2013)
Status: Walden has chosen to continue efforts to complete this action

4. *Acquire warning signs for area roads to warn of fog conditions.*

Responsible Agency: To be determined, TDOT
Priority: Low
Cost Estimate: Based on feasibility study
Benefit: Prevent traffic accidents
Potential funding source: TDOT, existing budget
Schedule: Discontinued
Status: Deleted: The National Weather Service and local media issue fog warnings to alert motorists of hazardous driving conditions. A review of past five years shows that it has not been a problem in the past that warrants further action.

<u>Unincorporated County</u>

Objectives

1. Remediate areas and structures that experience repeated flooding
2. Encourage conservation and/or responsible development of flood and erosion hazard areas to protect new and existing buildings and infrastructure
3. Erosion protection along sections of several creeks in the northern area of Hamilton County.

Preferred Actions

1. *Acquire funds to buy and remove or relocate homes along creeks prone to flooding or stream bank erosion.*

Responsible Agency: Hamilton County Public Works: Engineering
Priority: High
Cost Estimate: Based on feasibility study
Benefit: Relocation/Removal is more cost effective than repeated losses
Potential funding source: FMA, existing budget
Schedule: Continuous as funding becomes available
Status: Deferred

2. *Map channel migration hazard areas and implement development restrictions in susceptible areas.*

Responsible Agency: Hamilton County GIS, NRCS
Priority: High
Cost Estimate: Existing staff time
Benefit: Improve water quality; reduce exposure of new and existing development to erosion hazard
Potential funding source: PDM, existing budget
Schedule: Continuous
Status: Deferred

3. *Establish requirements for stream buffers.*

Responsible Agency: Public Works: Stormwater Management Committee, CHCRPA
Priority: High
Cost Estimate: Six months of staff time
Benefit: Improve regulatory authority, reduce vulnerability of new buildings and infrastructure, improve water quality, decrease rate and volume of rainfall runoff.
Potential funding source: Existing budget
Schedule: Continuous
Status: Deferred

4. *Raise Roberts Mill Road from Levi Road east to the Bens in Falling Water Creek*

Responsible Agency: Hamilton County Public Works: Engineering

Priority: Medium
Cost Estimate: Based on feasibility study
Benefit: Remedy chronic flooding of this area
Potential funding source: Existing budget
Schedule: Within 5 years (2016)
Status: Deleted: Based on further study, this action was discontinued

5. *Mackey Branch culvert replacement and detention from Standifer Gap Road to Shallowford Road.*

Responsible Agency: Hamilton County Public Works: Engineering
Priority: Medium
Cost Estimate: Based on feasibility study
Benefit: Flood control
Potential funding source: Existing budget
Schedule: Within 5 years (2016)
Status: Deleted: Based on initial investigation, this action was discontinued

6. *Raise Hunter Road in the 5800 address area.*

Responsible Agency:
Priority: Medium
Cost Estimate: Based on feasibility study
Benefit: Remedy chronic flooding of this area
Potential funding source: PDM, existing budget
Schedule: Within 5 years (2016)
Status: Deferred

University of Tennessee at Chattanooga

Objectives:

1. Reduce the potential for infrastructure induced flooding.
2. Reduce potential damage from severe storms and increase public preparedness.
3. Prepare the campus population to survive a tornado.
4. Prepare the campus population to reduce the need to draw on critical services during a tornado emergency.
5. Ensure adequate planning to prevent campus construction in erosion prone areas.
6. Educate campus populations who conduct research in wildfire prone areas on prevention techniques for wild fire.
7. Prepare the campus population to survive an earthquake
8. Prepare the campus population to reduce the need to draw on critical services during an earthquake emergency.

1. Upgrades to campus wide alerting system

Responsible Agency: Safety and Risk Management/Emergency Management
Priority: High

Cost Estimate: $200,000
Benefit: Improve the ability to alert the campus population and provide information on events which are occurring on or off campus
Potential funding source: US Department of Education
Schedule: Complete by 31 December 2011
Status: Vendor identified and purchase order issued. Installation began 28 June 2011

2. *Construct safe rooms for protection from tornado force winds*

Responsible Agency: Safety and Risk Management/Emergency Management
Priority: Moderate
Cost Estimate: $5,000,000
Benefit: Provide protection for campus populations and community members during a tornado emergency.
Potential funding source: Federal Emergency Management Agency
Schedule: Complete grant application by 30 June 2012
Status: Working with Hamilton County EMA to update the county mitigation plan in a manner which includes the University as a partner and a resource for the county.

3. *Develop comprehensive Emergency Management Plans, including Hazard and Risk Assessment, Mitigation, Response and Recovery*

Responsible Agency: Safety and Risk Management/Emergency Management
Priority: Moderate
Cost Estimate: $ No cost assigned
Benefit: Improving the workflow between campus and local emergency management officials allowing the campus to serve as a partner and a resource in local response.
Potential funding source: University of Tennessee
Schedule: 31 December 2012
Status: A full time emergency management professional is now on staff. Significant improvements have been made in interagency coordination and planning due to increased university capabilities. Draft response plans are in place.

4. *Improve response communications capabilities by migrating the campus to the TVRS Public Safety Communications System*

Responsible Agency: Safety and Risk Management/Emergency Management
Priority: Moderate
Cost Estimate: $150,000
Benefit: Improved communications during the run-up to any forecasted emergency as well as during the response and recovery phase.
Potential funding source: Stimulus funds
Schedule: 31 December 2011
Status: 60% of the campus is now on this system

5. *Development and implementation of a campus wide business continuity plan*

Responsible Agency: Safety and Risk Management/Emergency Management
Priority: Moderate

Cost Estimate: Cost not assigned
Benefit: Improved ability to continue providing both essential and mission services during an emergency
Potential funding source: University of Tennessee
Schedule: 1 July 2012
Status: Data gathering and dependency identification are ongoing.

6. *Development of Threat, Risk and Vulnerability Assessments with associated data gathering and upgrades to tactical emergency response plans.*

Responsible Agency: Safety and Risk Management/Emergency Management
Priority: High
Cost Estimate: $10,000
Benefit: Provide responders with information needed to quickly and accurately assess campus incidents resulting from natural or man-made events.
Potential funding source: US Department of Education
Schedule: 1 July 2012
Status: Format and software have been identified. Data gathering has not started.

Hamilton County Board of Education

Objectives:

1. Prepare the school population and surrounding community residents to survive a tornado.
2. Reduce the need to draw on critical services during a tornado emergency.

1. *Construct safe community rooms or corridors in new and/or existing schools to provide students and community residents protection from tornado force winds*

Responsible Agency: Hamilton County Department of Education
Priority: High
Cost Estimate: $8,000,000 for four schools
Benefit: Provide protection for school populations and community members during a tornado event.
Potential funding source: Federal Emergency Management Agency
Schedule: Complete grant application by 30 June 2013
Status: New action

Chapter 5 – Monitoring, Evaluation, Updating the Plan, and Public Involvement

The Hamilton County Emergency Management Agency (HCEMA) will establish a program to monitor the mitigation activities for all participating jurisdictions in the County on a yearly cycle. HCEMA will maintain a file of mitigation actions or activities that they review and will report annually to the Tennessee Emergency Management Agency (TEMA) on the progress in meeting the requirements of the Hazard Mitigation Plan.

The HCEMA will work to facilitate expansion of the Hazard Mitigation Planning Group to include representatives of local businesses and commercial interests, the academic community, citizen groups, and relevant government agencies. The community of Lakesite will be encouraged to participate in the National Flood Insurance Program and thus gain eligibility to join in the planning process and be included in future plan updates. The Committee will review the Natural Hazard Mitigation Plan on an annual basis. Updates to the plan will be posted on the HCEMA website for public review and comment. A notice of updates to the Plan, including a summary of the proposed update, will be provided to the local media for publication and to participating local governments. Comments from the public and participating governments will be solicited and the proposed update modified, as appropriate, to respond to these comments. Administrative changes, wording corrections, hazard analysis, or other such portions of the Mitigation Plan, should not require additional action by local elected bodies. However, changes that may have a significant impact or significant expenditure of non-budgeted funds may require action by respective elected bodies.

FEMA is currently coordinating a Flood Scoping Study to update local flood maps. The results of the flood map update will most likely result in the necessity to update the plan prior to the five-year requirement. Thereafter, the plan will be updated every five (5) years by the Hazard Mitigation Planning Committee or as required under 44CFR201.6(c) (4) (i). Plan updates will be submitted to the Tennessee State Hazard Mitigation Officer and FEMA for approval.

Changes in development, technology or the capability of local jurisdictions to implement the actions adopted in the plan could necessitate the need for revisions in the plan. There are many issues that the monitoring and evaluation process should include:

- The adequacy of jurisdiction resources to implement the strategies as adopted
- Any redundancy among strategies that can be eliminated to free-up resources
- Whether adequate funding is available for implementation of the strategies as adopted
- Any technical, legal or coordination problems associated with implementation

- Whether mitigation actions are being implemented according to the prioritization scope

However, the primary issue that monitoring and evaluation should address is whether vulnerability has decreased as a result of the actions adopted in the plan. Where vulnerability has decreased, the Committee should determine why and consider implementing successful mitigation actions in other locations. Where vulnerability has remained constant or increased, the Committee should identify whether additional measures might be more successful or whether revisions should be made to existing measures. For example, the city of East Ridge worked diligently to update its mitigation actions to better address continued problems with flooding.

As previously noted, changes in development, technology or the capability of the planning area to implement the strategies adopted in the plan could alter the ability of the planning area to implement the mitigation strategies identified and adopted in their plan or could necessitate the need for new strategies to be identified. As a result, update and revision is a necessary part of the Hazard Mitigation planning process. While monitoring and evaluation are ongoing processes, update and revision will occur at regularly scheduled intervals.

Implementation through Existing Programs

Hamilton County and local jurisdictions address planning goals and legislative requirements through its Land Use Plans, Flood Hazard Ordinances, Stormwater Management Plans, Zoning Ordinances, Building Codes, and Capital Improvement Plans. The Hamilton County Natural Hazards Mitigation Plan provides a series of goals, objectives, and actions that are closely related to the goals and objectives of these existing planning programs. Hamilton County and local jurisdictions will have the opportunity to implement adopted mitigation strategies through existing programs, procedures and land use plan updates.

Land Use Plans are updated on a cyclical basis and will incorporate information from the NHMP as appropriate. As an example, the Comprehensive Plan 2030 prepared in 2006, incorporated information from the NHMP (2005) and development trend reports prepared by the agency incorporated information from the plan to highlight areas that may have special considerations to address in the process of development.

Plans currently maintained by the CHCRPA include: Avondale (2004), Alton Park (2000), Brainerd Hills Plan (2002), Brainerd Road / Lee HighwayRevitalization Plan (1994), Brainerd Town Center (1998), Bush town (2000), Comprehensive Plan 2030 (in progress), Downtown (2004), East Brainerd (1990), East Brainerd Corridor Community Plan (2003), East Chattanooga Area Plan (2004), Eastdale (1998), Glenwood / Churchville / Orchard Knob Neighborhood Plan (2002), Hamilton Place Community Plan (2000), Highland Park (2000), Highway 58 Community Plan (2002), Hill City - Northside (2003), Hixson - North River Community Plan (2004), Lookout Valley (2003), Mountain Creek Greenway Plan (2003), North Brainerd Area Plan (2004), North Suburban Area (1991), Oak Grove Neighborhood Plan (2004), Ridgedale (1998), Rossville Boulevard Community Plan (2004), Shallowford Road - Lee Highway Area Plan (2005), Soddy-Daisy Comprehensive Plan 2020, Southside (1997), St. Elmo (2001) 2020 Plan (2001), TransPlan 2030, Comp Plan 2030.

Enhancing Public Involvement

Traditional media, such as newspaper will still be used to notify the public of significant events related to the plan. However the rise of social media presents a unique opportunity to engage the public in the planning process. HCEMA is currently working to develop an enhanced website that will include the ability to provide valuable mitigation information ,as well as to solicit public involvement in the planning process through various social media outlets. The public will be kept informed of proposed changes, modifications, reviews, and updates to the plan by advertising that such updates, modifications, and reviews are being considered. Copies of the 2005 plan were distributed to local libraries and seats of local government. In addition, a copy of the 2005 plan has been maintained on the CHCRPA website.

Appendix

Definitions

(Not all terms are used in the current version of the plan, but are included for future reference)

Annual Flood:
The maximum discharge peak during a given water year (October 1 - September 30).

Attenuation:
The process where the flood crest is reduced as it progresses downs

Backflow:
The backing up of water through a conduit or channel in the direction opposite to normal flow.

Backwater Flooding:
Upstream flooding caused by downstream conditions such as channel restriction and/ or high flow in a downstream confluence stream.

Bankfull Stage/Elevation:
An established river stage/water surface elevation at a given location along a river that is intended to represent the maximum water level that will not overflow the riverbanks or cause any significant damages from flooding.

Base Flood:
The national standard for floodplain management is the base, or one percent chance flood. This flood has at least one chance in 100 of occurring in any given year. It is also called a 100-year flood.

Daily Flood Peak:
The maximum mean daily discharge occuring in a stream during a given flood event.

Detention Basins:
Structures that are built upstream from a populated area so that precipitation flows do not flood and cause the loss of life or property. They are normally dry, but are designed to detain surface water temporarily during, and immediately after a runoff event. Their primary function is to attenuate the storm flows by releasing flows at a lower flow rate. There are no gates or valves allowed on the outlet so that water can never be stored on a long-term basis. Typical detention times in such a basin would be on the order of 24 to 72 hours although some are as long as 5 to 10 days.

Drought:

A period of abnormally dry weather sufficiently prolonged from the lack of precipitation to cause a serious hydrologic imbalance.

Drought Index:

Computed value that is related to some of the cumulative effects of a prolonged and abnormal moisture deficiency. (An index of hydrological drought corresponding to levels below the mean in streams, lakes, and reservoirs.)

Dry Floodproofing:

A dry floodproofed building is sealed against floodwaters. All areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings like doors windows, sewer lines and vents are closed, wether permanently, with removable shields, or with sandbags. The flood protection level should be no more than 2 or 3 feet above the top of the foundation because the buildings walls and floors cannot withstand the pressure of deeper water.

Wet Floodproofing:

An approach to floodproofing that usually is a last resort. Floodwaters are intentionally allowed into the building to minimize water pressure on the structure. Wet Floodproofing can include moving a few valueable items to a higher place or completely rebuilding the floodable area. Wet floodproofing has an advantage over other approaches: not matter how little is done, flood damage will be reduced. Thousands of dollars in damage can be avoided just by moving furniture and appliances out of the flood-prone area.

Flash Flood:

A flood which follows within a few hours (usually less than 6 hours) of heavy or excessive rainfall, dam or levee failure, or the sudden release of water impounded by an ice jam.

Flash Flood Guidance (FFG):

An internal product produced by the RFC's containing rainfall threshold values that must be exceeded in order to produce a flash flood.

Flash Flood Statement (FFS):

A statement by the NWS, which provides follow-up information on flash flood watches and warnings.

Flash Flood Table:

A table of pre-computed forecast crest stage values for small streams for a variety of antecedent moisture conditions and rain amounts. Soil moisture conditions are often represented by flash flood guidance values. In lieu of crest stages, categorical representations of flooding, e.g., minor, moderate, etc. may be used on the tables.

Flash Flood Warning (FFW):

A warning by the NWS issued to warn of flash flooding that is imminent or occurring.

Flash Flood Watch (FFA):

A statement by the NWS that alerts communities to the possibility of flash flooding in specified areas

Flood:

The inundation of a normally dry area caused by high flow, or overflow of water in an established watercourse, such as a river, stream, or drainage ditch; or ponding of water at or near the point where the rain fell. This is a duration type event with a slower onset than flash flooding, normally greater than 6 hours.

Flood Control Storage:

Storage of water in reservoirs to abate flood damage.

Flood Crest:

The Maximum height of a flood wave as it pases a location.

Flood Frequency Curve:

(1) A graph showing the number of times per year on the average, plotted as abscissa, that floods of magnitude, indicated by the ordinate, are equaled or exceeded. (2) A similar graph but with recurrence intervals of floods plotted as abscissa.

Flood Loss Reduction Measures:

The strategy for reducing flood losses. There are four basic strategies. They are prevention, property protection, emergency services, and structural projects. Each strategy incorporates different measures that are appropriate for different conditions. In many communities, a different person may be responsible for each strategy.

Flood of Record:

The highest observed river stage or discharge at a given location during the period of record keeping. (Not necessarily the highest known stage.)

Flood Plain:

The portion of a river valley that has been inundated by the river during historic floods.

Flood Plain Information Studies:

Reports usually prepared by the U.S. Army Corps of Engineers (USACE) following a survey of a flood-impacted community.

Flood Potential Outlook (ESF on AFOS) (FPO for Acronym):

An NWS outlook that is issued to alert the public of potentially heavy rainfall that could send area rivers and streams into flood or aggravate an existing flood.

Flood Prevention:

Measures that are taken in order to keep flood problems from getting worse. Planning, land acquisition, river channel maintenance, wetlands protection, and other regulations all help modify development on floodplains and watersheds to reduce their susceptibility to flood damage. Preventive measures are usually administered by the building, zoning, planning and/ or code enforcement offices of the local government.

Flood Problems:

Problems and damages that occur during a flood as a result of human development and actions. Flood problems are a result from: **1)** Inappropriate development in the floodplain (e.g., building too low, too close to the channel, or blocking flood flows); **2)** Development in the watershed that increases flood flows and creates a larger floodplain, or; **3)** A combination of the previous two.

Flood Profile:

A graph of elevation of the water surface of a river in flood, plotted as ordinate, against distance, measured in the downstream direction, plotted as abscissa. A flood profile may be drawn to show elevation at a given time, crests during a particular flood, or to show stages of concordant flows.

Flood Routing:

Process of determining progressively the timing, shape, and amplitude of a flood wave as it moves downstream to successive points along the river.

Flood Stage:

A gage height at which a watercouse overtops its banks and begins to cause damage to any portion of the defined reach. Flood stage is usually higher than or equal to bankful stage.

Flood Statement (FLS):

A statement issued by the NWS to inform the public of flooding along major streams in which there is not a serious threat to life or property. It may also follow a flood warning to give later information.

Flood Warning (FLW):

A release by the NWS to inform the public of flooding along larger streams in which there is a serious threat to life or property. A flood warning will usually contain river stage (level) forecasts.

Flood Wave:

A rise in streamflow to a crest and its subsequent recession caused by precipitation, snowmelt, dam failure, or reservoir releases.

Floodproofing:

The process of protecting a building from flood damage on site. Floodproofing can be divided into wet and dry floodproofing. In areas subject to slow-moving, shallow flooding, buildings can be elevated, or barriers can be constructed to block the water's approach to the building. These techniques have the advantage of being less disruptive to the neighborhood. It must be noted that during a flood, a floodproofed building may be isolated and without utilities and therefore unusable, even though it has not been damaged.

Floodwall:

A long, narrow concrete or masonry embankment usually built to protect land from flooding. If built of earth the structure is usually referred to as a levee. Floodwalls and levees confine streamflow within a specified area to prevent flooding. The term "dike" is used to describe an embankment that blocks an area on a reservoir or lake rim that is lower than the top of the dam.

Floodway:

(1) A part of the flood plain, otherwise leveed, reserved for emergency diversion of water during floods. A part of the flood plain which, to facilitate the passage of floodwater, is kept clear of encumbrances.(2) The channel of a river or stream and those parts of the flood plains adjoining the channel, which are reasonably required to carry and discharge the floodwater or floodflow of any river or stream.

Major Flooding:

A general term including extensive inundation and property damage. (Usually characterized by the evacuation of people and livestock and the closure of both primary and secondary roads.)

Moderate Flooding:

The inundation of secondary roads; transfer to higher elevation necessary to save property -- some evacuation may be required.

Minor Flooding:

A general term indicating minimal or no property damage but possibly some public inconvenience.

One Percent Chance Flood (One Hundred Year Flood):

flood magnitude that has one chance in 100 of being exceeded in any future 1-year period. The occurrence of floods is assumed to be random in time, or regularity of occurrence is implied. The exceeding of a 1-percent chance is no guarantee, therefore, that a similar size flood will not occur next week. The risk of experiencing a large flood within time periods longer than 1 year increases in a nonadditive fashion. For example, the risk of exceeding a 1-percent chance flood one or more times during a 30-year period is 25 percent and during a 70-year period is 50 percent.

Palmer Drought Severity Index:

An index whereby excesses or deficiencies of precipitation are determined I relation to average climate values. The index takes in to account precipitation, potential and actual evapotransporation, infiltration of water into the soil, and runoff.

Upstream Slope:

The part of the dam that is in contact with the reservoir water. On earthen dams, this slope must be protected from the erosive action of waves by rock riprap or concrete.

Urban Flash Flood Guidance:

A specific type of flash flood guidance, which estimates the average amount of rain needed over an urban area during a specified period of time to initiate flooding on small, ungaged streams in the urban area.

Urban Flooding:

Flooding of streets, underpasses, low lying areas, or storm drains. This type of flooding is mainly an inconvenience and is generally not life threatening.

Storm Hydrograph:

A hydrograph representing the total flow or discharge past a point.

Stormwater Discharge:

Precipitation that does not infiltrate into the ground or evaporate due to impervious land surfaces but instead flows onto adjacent land or water areas and is routed into drain/sewer systems.

Regulatory Floodway :

Some maps show an area where construction regulations require special provisions to account for this extra hazard. This is a regulatory floodway

Recurrence Interval :

The average amount of time between events of a given magnitude. For example, there is a 1% chance that a 100- year flood will occur in any given year.

Reach :

The distance between two specific points outlining that portion of the stream, or river for which the forecast applies. This generally applies to the distance above and below the forecast point for which the forecast is valid.

Hamilton County Natural Hazards Mitigation Plan Survey

Please attach information if the space provided is insufficient.

1. Community Name
_____

2. Name, phone number, fax and e-mail address of contact person(s) for your community information:

_____

_____

3. Does your community have a web site? If yes, what is the URL address?
_____

4. Please provide background information on your community's "history," such as when it was organized, when it became a city, interesting people from your community, how it got its name and any other important or interesting facts?
_____

_____

_____

5. Please list significant historical natural events that occurred in your community including the location and estimated cost of damage (if available).

_____

_____

_____

_____

_____

_____

6. What infrastructure concerns does your community have as it relates to flooding (for example, please list any intersections, culverts, and or bridges that have systemic flooding issues)?
_____

_____

_____

_____

7. Please provide a list of addresses/phone numbers of all your critical facilities? Critical facilities are defined as hospitals, schools, nursing homes, fire and police stations, government building, prisons etc.

8. Does your community have any facilities that have the ability to hold large crowds such as arenas, sporting events, etc.? If yes, please give the name and location of these facilities.

9. Does your community have any type of early warning detection system(s)?

Please describe:

_____

_____

_____

_____

10. Are any of the following natural hazards a serious concern in your community?
Please rank based on severity with:

3 -serious concern
2 - moderate concern
1 - low concern
0 – not a concern

Floods
___100-year Floodplain Floods - *defined with the NFIP Maps*
___ Flash Floods - *defined as flooding that follows heavy rain*
___ Non-Flood Zone Floods - *defined as flooding that occurs in areas not defined as floodplains, usually in areas that have been developed at a fast rate.*

Tornadoes
___ Tornadoes

Severe Storm
___ Ice Storms
___ Hail
___ Winter Storms
___ Thunderstorms
___ High and Low Temperatures
___ Lightning
___ High Winds

Erosion
___ Stream Bank
___ Landslide

Earthquakes
___ Earthquakes

Droughts
___Wildfires

11. Are there other natural hazards not mentioned above that your community has experienced?

_____

_____

_____

_____

12. Please provide the following documents if available.
1. Comprehensive Plan(s)
2. Floodplain Ordinance(s)
3. Land Use Ordinance(s)

Are there any other documents you think we should look at? (please provide)
_____

_____

13. Please describe actions that your community has taken or plans to take to mitigate the impact of natural hazards.
_____

_____

_____

_____

_____

_____

14. Please list mitigation actions that your community would like to take, but would require state and/or federal funding.
_____

_____

_____

_____

_____

_____

15. List the overall **goals** that your community hopes to achieve through the Hamilton County Natural Hazard Mitigation Plan.
Example: Reduce flood damage in _____.
_____

_____

_____

16. Please list any specific **objectives** that your community hopes to achieve through the Hamilton County Natural Hazard Mitigation Plan.

Example: Minimize future damage due to flooding of Spring Creek.

17. Please list any specific **actions** that your community would recommend to alleviate natural hazards.

Example: Work with existing floodplain residents to elevate or floodproof their structures, including obtaining funding assistance and technical guidance.

2030 POPULATION PROJECTIONS METHODOLOGY

The starting point for these projections was the total projected population for Hamilton County. This projection was provided by the Tennessee Department of Transportation (TDOT), and was developed by the Center for Business and Economic Research (CBER) at the University of Tennessee. The total projected 2030 population for Hamilton County is 362,334. This represents an increase of 54,437 people, or 17.7% over the 2000 base year population from the U. S. Census.

The following steps were used to estimate the projected population for each of the 310 TAZs. The 2030 total projected population was allocated among the TAZs based on the same proportions in the base year of 2000. In effect, this produced a 17.7% increase in population in every TAZ. This necessitated adjustments to the TAZs based on assumed future growth patterns and historical growth rates, with the following procedures:

1. Hamilton County population data was obtained for Census years 1970, 1980, 1990 and 2000 normalized to the 2000 Census Tract boundaries. This data was obtained from a demographics firm, SRC, LLC. which offers services such as “Demographics Now” and “Free Demographics.”
2. Historical growth trends were analyzed for each Census Tract, and the growth pattern in a particular Census Tract was assigned to the TAZs within that tract. For instance, if a tract had experienced population decreases from 1970 to 1980, from 1980 to 1990, and from 1990 to 2000, its growth pattern was designated DDD (meaning Decrease, Decrease, Decrease). Similarly, the designation of III would indicate a growth pattern of Increases in each of the three decades from 1970 to 2000. The TAZs within each Census Tract were assigned the same pattern as the Census Tract.
3. The allocated 2030 population (from Step 1) was then assigned an adjustment factor based on past growth rates and expected future growth or decline patterns, current land use, topographical features, available developed land, and subdivision and building permit trends. These adjustment factors ranged from 0.65 to 1.45, which translate into percentage growth rates of -24% to +71%. When the adjustment factor was multiplied by the allocated 2030 population, an adjusted 2030 population figure and a 2000-2030 growth rate was established.
5. Further adjustments were made to TAZ’s in selected Census Tracts based on growth patterns in surrounding tracts. For instance, a particular tract initially may have been assigned a higher or lower adjustment factor/growth rate (based on past growth) than its neighboring tracts. If there was no specific information to justify its pattern being different from its neighboring tracts, the adjustment factor was changed to be more in line with the neighboring tracts.
6. These adjustments resulted in a total 2030 population projection for all the 310 TAZs of 362,330, or 4 less than the total Hamilton County projection of 362,334.
7. Population projections by TAZ were summed for each Census Tract

Regional Notice

Re: Hamilton County Natural Hazards Mitigation Plan

Dear Mayor_____,

The purpose of this letter is to notify adjacent county governments that Hamilton County, Tennessee is in the process of updating our Natural Hazards Mitigation Plan. The current plan was approved by the Federal Emergency Management Agency in 2005. The plan must be updated every five years. The revised plan will update local demographics, development trends, risk and vulnerability to natural hazards, hazard related events, and the status of past mitigation actions. Several participating local jurisdictions have revised their mitigation actions to reflect local concerns, as well as capability for implementation.

If you have any questions or would like to review and comment on a draft of the updated plan please contact Greg Helms at 423-209-6917.

Marion, Sequatchie, Bledsoe, Rhea, Meigs, Bradley, Dade, Walker, Catoosa

Problem Flood Areas (Flash Flood)

Chattanooga

Stormwater

1. Brown's Ferry Road @ Parker Lane
2. Astor Avenue near pump station
3. Wauhatchie Pike @ Cummings Road
4. North Moss Avenue @ Center Street
5. Manning Street @ Stringer Street
6. Mountain Creek Road @ Cross Street (private)
7. Brown's Ferry Road @ Waterfront Drive
8. Dayton Boulevard and Old Dayton Pike
9. 680 Signal Mountain Road
10. Cummings Highway (Broad Street to Church Street)
11. Church Street (Cummings Highway to West 38th Street)
12. West 38th Street (St. Elmo Avenue to Dead End)
13. Main Street @ Railroad Underpass
14. Vine Street (Georgia Avenue to Douglas Street)
15. Market Street (4th Street to 8th Street)
16. 10th and 11th Streets (Park Avenue to Douglas Street)
17. West 33rd Street (Between Broad Street and Alton Park Blvd.)
18. 20th Street @ Washington Street
19. 800 Hooker Road
20. Workman Road
21. 900 East 11th Street
22. 1500 East 23rd Street
23. Rossville Boulevard (Interstate 24 area)
24. 23rd Street @ 4th Avenue
25. Forest Plaza Subdivision
26. Birmingham Drive
27. Atlanta Drive
28. Memphis Drive
29. 109 Valleybrook Road
30. Valleybrook Subdivision
31. 409 Valleybrook Road
32. Gadd Road @ Hixson Recreation Center
33. Adams Road @ Crescent Club Drive
34. Grubb Road @ School Drive
35. Boy Scout Road
36. Austin Road @ Orchard Business Park
37. 1499 Lower Mill Road
38. 1244 Village Green Drive
39. 5613 Winding Lane
40. 1317 Windbrook Lane
41. 4121 Hixson Pike
42. Highway 153 and Hamil road

43. Ely Road and Delashmitt Road
44. Taylor Street and Dodson Avenue
45. Amnicloa Highway and Crotchfield Street
46. Shallowford Road and Wilcox Boulevard
47. Lyerly Street @ Ivy Street
48. 3510 and 3515 Taylor Street
49. Brainerd Road @ Brainerd Village
50. Brainerd Road @ East Brainerd Road
51. Chickamauga Road
52. Brainerd Road @ Provence Street
53. Dodson Avenue and 3rd Street
54. Brainerd section of town bounded by the Brainerd Levee on the east, Kenwood on the west, Interstate 24 on the south, to Brainerd High School on the north
55. Lee Highway and Shallowford Road (between Robinson Drive and Jordan Drive)
56. Hickory Valley Road @ Hickory Brook Drive
57. Davidson Road @ Mackey Road
58. East Brainerd Road @ Mackey Avenue
59. 7000 block of Lee Highway
60. 520 and 900 Airport Road
61. 7300 Standifer Gap Road
62. 7200 Noah Reid Road
63. Bonny Oaks Drive @ Redlands Drive
64. Bonny Oaks Drive @ Jersey Pike
65. Hickory Brook Road
66. Noah Reid Road @ Shallowford Road
67. Oakwood Drive @ Highway 58
68. Oakwood Drive @ Jersey Pike
69. Standifer Gap @ Friars Branch
70. 2330 Hickory Valley Road
71. Alton Park Area (Polk, Fagan, and Dorris Streets)

Waste Resources

1. Combined Sewer System and related CSO Facilities
2. South Chickamauga Creek Interceptor Sewer and related collection sewers
3. North Chickamauga Creek Interceptor Sewer and related collection sewers
4. Mountain Creek Interceptor Sewer and related collection sewers
5. Chattanooga Creek Interceptor Sewer and related collection sewers
6. Riverview sewers through Chattanooga Golf and Country Club
7. Engle Stadium area
8. Vine Street and Lindsey
9. 23rd Street
10. City Yards

Parks and Recreation

1. Culvert @ N. Chickamauga Creek Greenway ¼ mile north of Hamill Rd.
2. Culvert @ Rivermont Park @ driveway to Champions Club

3. Parking area @ Heritage Park
4. Tennis Courts, Fieldhouse @ Warner Park
5. Landscaping @ Coolidge Park
6. Structure & Playing Field @ Engel Stadium

Soddy-Daisy

1. Chickamauga Creek Bridge
2. Dayton Pike
3. Daisy Dallas Road
4. O'Sage Drive

East Ridge

1. Severe over bank flooding of Spring Creek
2. Upstream of Ringgold Rd along Springvale Rd
3. Upstream of Spring Creek Rd along Graston Ave, Wentworth Avenue, and Wellworth Avenue.
4. Downstream of Ringgold Rd along Swope Drive, Oakdale Avenue, West End Avenue, Marion Avenue, Pleasant Street, Connell Street, and Merida Street.

Collegedale

1. 4-Corners Intersection
2. Tucker Road
3. Old Camp Road
4. Sunrise Meadows Subdivision
5. Landrum Subdivision
6. Tallent and Edgmon Road

Red Bank

1. Memorial Drive Bridge at Dayton Boulevard/Lyndon Avenue

Signal Mountain

1. Headwater flooding across US 127
2. Groundwater has pulled fines out of backfill in utility trenches leading to collapse

Unincorporated County

1. Middle Valley Road between Eagle Drive and Thrasher Pike
2. Roberts Mill Road from Levi Road east to the bend in Falling Water Creek
3. Mackey Branch from Standifer Gap Road to Shallowford Road
4. Hunter Road in the 5800 address area
5. Erosion along Rock Creek and Falling Water Creek

Natural Hazards Internet Resources: A Guide for Hamilton County Communities

With the rapid expansion of information available on the Internet, the search for information on a specific topic is often laborious and frustrating. This guide provides a listing of pertinent natural hazards web pages in an effort to make the search for hazards information easier. Web pages are included with the potential use of local government officials and community leaders in mind. Web page citations include the title, web page address, and a brief description. Web pages are grouped into the following categories:

- Natural Hazards Preparedness: Includes web pages dedicated to disaster planning, safety tips and contingency planning.
- Natural Hazards Response: Includes web pages of organizations dedicated to immediate response in the wake of a natural disaster.
- Natural Hazards Mitigation: Includes web pages dedicated to reducing the vulnerability of properties and lives to repetitive loss due to successive natural hazards events.
- Natural Hazards Information: Includes web pages that generally describe natural hazards.
- Natural Hazards Literature: Includes web pages that provide information on natural hazards publications, databases, networks, and other relevant links on the Internet.
- Natural Hazards Research Tools: Includes web pages that offer technical tools used for understanding the spatial and temporal characteristics of natural hazards and their impacts.
- Specific Natural Hazards Categories: Includes web pages dedicated to providing information and resources related to the following specific natural hazards: earthquakes, floods, weather hazards (with climate resources), and wildfire.

Natural Hazards Preparedness:

Tennessee Emergency Management Agency
http://www.tnema.org/
Hazard information for the state of Tennessee

Disaster Resources Guide
http://www.disaster-resource.com/
Guide to business continuity planning.

USA Today: Natural Disaster Safety Tips
http://www.usatoday.com/weather/wsafe0.htm
General information about natural hazard event preparedness, including links to key state/federal web sites.

DERA: Disaster Preparedness and Emergency Response Association
http://www.disasters.org/
Disaster preparedness information in several languages.

Institute for Business and Home Safety
http://www.ibhs.org/
Resource for insurers and reinsurers to reduce harm caused by natural disasters.

National Emergency Management Association
http://www.nemaweb.org/
National coordinating body for state comprehensive emergency management leaders.

Southern Building Code Congress International
http://www.sbcci.org/
Building Code technical, educational, and administrative support for government agencies.

FEMA
http://www.fema.gov/plan/prevent/property.shtm

Small Business Administration: Disaster Information
http://www.sba.gov/services/disasterassistance/disasterpreparedness/index.html
Disaster preparedness and recovery information focused on small businesses, including disaster loan program.

Natural Hazards: Response:

American Red Cross
http://www.redcross.org/
National relief agency for victims of natural and man-made disasters in the United States.

Salvation Army: Southern Region
http://www.uss.salvationarmy.org/uss/www_uss.nsf
National relief agency for victims of natural and man-made disasters in the United States.

US FEMA: Federal Emergency Management Agency
http://www.fema.gov/
Homepage for the Federal Emergency Management Agency: Current information and links.

Natural Hazards Information:

USGS: Natural Hazards Gateway
http://www.usgs.gov/hazards/
Natural Hazards Research and Information Center: Natural Hazards Observer
http://www.colorado.edu/hazards/o/
Newsletter of the Natural Hazards Research and Applications Information Center.

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Natural Hazards Literature:

National Hazards Research and Applications Information Center:
Bibliography
http://www.colorado.edu/hazards/library/
Bibliography of social science literature focusing on natural disaster preparation, recovery and mitigation.

FEMA: USFA: Publications
http://www.usfa.fema.gov/usfapubs/online.htm
Bibliography and on-line report access to technical issues related to fire.

Natural Hazards Research Tools:

Tennessee Geographic Information Resources
http://www.tngis.org/
Geographic information for Tennessee.

Earthquakes/Landslides

Center for Earthquake Education and Research
http://www.ceri.memphis.edu/
Public information, seismic data, and links from the University of Memphis.

American Red Cross: Earthquake Preparedness
http://www.crossnet.org/disaster/safety/earth.html
Earthquake preparedness information.

Building Seismic Safety Council
http://www.bssconline.org/
Organization responsible for developing and promoting building earthquake risk mitigation regulatory provisions.

Earthquake Information Network
http://www.eqnet.org/
Links to earthquake information and databases, with a focus on mitigation efforts.

USGS: Earthquake Hazards and Preparedness
http://quake.wr.usgs.gov/hazprep/index.html
Information on earthquake hazards, preparedness and fact sheets on scientific research.

USGS: Geologic Hazards Team
http://geohazrds.cr.usgs.gov/

USGS information on geologic hazards, including earthquakes and landslides.

USGS: National Earthquake Information Center
http://wwwneic.cr.usgs.gov/
Information on USGS earthquake data, research and current activity.

USGS: Geologic Hazards: Landslides
http://landslides.usgs.gov/landslide.html
Landslide publications, research, and recent events.

Floods

Association of State Floodplain Managers
http://www.floods.org/
Organization interested in floodplain management, flood hazard mitigation, NFIP, and flood preparedness, warning and recovery.

Floodplain Management Association
http://www.floodplain.org/
Information on floodplains and general information on floods.

National Association of Flood and Stormwater Management Agencies
http://www.nafsma.org/
Current information on legislative activity related to public policy on stormwater, flood control, watersheds and floodplains.

US Army Corps of Engineers
http://www.usace.army.mil/
Homepage for the U.S. Army Corps of Engineers: Current information and links.

FEMA: National Flood Insurance Program (NFIP)
http://www.fema.gov/nfip/
Homepage for FEMA's National Flood Insurance Program.

USGS: Water WebServer Team
http://h2o.usgs.gov/public/realtime.html
Real-time hydrologic data for stream gages throughout the United States.

Weather Hazards/Climate Resources

Tornado Project
http://www.tornadoproject.com/

Comprehensive collection of tornado statistics and resources for meteorological interests and emergency managers.

NOAA: AOML: Hurricanes and Natural Disaster Brochures
http://www.aoml.noaa.gov/general/lib/hurricbro.html
Information on natural hazards, including hurricanes tornadoes, lightning, floods, thunderstorms and hail.

NOAA: Climate Prediction Products
http://nic.fb4.noaa.gov/products/predictions/
Climate forecasts and outlooks for the U.S. from 6-10 days to seasonal to ENSO predictions.

NOAA: National Climatic Data Center
http://www.ncdc.noaa.gov/
Access to Climate data for the U.S., including surface data, radar and satellite data, plus climate extremes/weather event summaries.

NOAA: NCDC: Climate Data Visualization
http://www.ncdc.noaa.gov/onlineprod/drought/xmgr.html
Climate visualization tool for national weather service, climate division, and selected global information.

NOAA: Southern Regional Climate Center
http://www.srcc.lsu.edu/
Climate services and data for the Southern U.S.

USDA: Agricultural Weather and Climate
http://www.usda.gov/oce/waob/jawf/poplinks.htm
Climate impact information for the U.S. with an emphasis on agricultural impacts.

Project SafeSide: Keeping You Ahead of the Storm
http://www.weather.com/safeside/
General information about natural hazards, preparedness, and disaster assistance.

NOAA: Interactive Weather Information Network
http://iwin.nws.noaa.gov/iwin/graphicsversion/main.html
A comprehensive link to current National Weather Service advisories, forecasts, and forecast discussions.

NOAA: National Hurricane Center: Tropical Prediction Center
http://www.nhc.noaa.gov/
Hurricane forecasts, as well as historical and general information, including a glossary of terms.

NOAA: Tornadoes: Nature's Most Violent Storms
http://www.nssl.noaa.gov/NWSTornado/
Background information on tornadoes, plus preparedness information.

NOAA: Weather Radio
http://www.nws.noaa.gov/nwr/nwrbro.htm
NOAA weather radio transmitter information for all fifty states and U.S. territories.

USDA: Weekly Weather and Crop Bulletin
http://www.usda.gov/oce/waob/jawf/wwcb.html
Weekly report on precipitation, Palmer Drought Indices, agricultural summaries and related weather information.

Wildfires/Drought

Wildfire: Are You Prepared?
http://www.disasterrelief.org/Library/Prepare/wildfire.html
Guide to wildfire safety and preparedness for an international audience.

US National Interagency Fire Center
http://www.nifc.gov/
Current information on wildland fire, fire safety, and science/technology applications to fire fighting.

U.S. Fire Administration
http://www.usfa.fema.gov/
Response and mitigation agency for fire provides fire safety information related to hurricanes and floods.

USDA: Forest Management: Fire
http://www.fs.fed.us/land/
Response to fire in forest service lands, including fire reporting.

Public Notice

2334993
HAMILTON COUNTY EMERGENCY
NHMP
Natural Hazards Mitigation Plan

STATE OF TENNESSEE
HAMILTON COUNTY

Before me personally appeared Linda Johnson who being duly sworn, that she is the Legal Sales Representative of the "CHATTANOOGA TIMES FREE PRESS" and that the Legal Ad of which the attached is a true copy, has been published in the above said Newspaper on the following dates, to-wit:

July 11, 2011

And that there is due or has been paid the "CHATTANOOGA TIMES FREE PRESS" for publication of such notice the sum of $76.50 Dollars. (Includes $10.00 Affidavit Charge).

Linda Johnson

Sworn to and subscribed before me, this 13 day of July 2011.

D Corie Soto

My Commission Expires 2/18/2014

D. CORIE SOTO
STATE OF TENNESSEE NOTARY PUBLIC
COUNTY OF HAMILTON

Chattanooga Times Free Press

PUBLIC NOTICE

The public is invited to review and comment on a draft of the 2011 update of the Hamilton County Natural Hazards Mitigation Plan (NHMP).

The purpose of the Plan is to outline a strategy with specific programs and policies that can be implemented by Hamilton County and local units of government within Hamilton County to reduce the impact of natural hazards on people and property.

A copy of the draft plan can be accessed online at http://www.hamiltontn.gov/emergencymanagement/emnews-releases.htm

For more information, contact Greg Helms at 423-209-6917 or by e-mail, gregoryh@hamiltontn.gov

HAMILTON COUNTY
OFFICE OF THE COUNTY MAYOR
208 Courthouse
Chattanooga, Tennessee 37402

CLAUDE RAMSEY
County Mayor

September 15, 2010

Commissioner Bebe Heiskell
P. O. Box 445
LaFayette, GA 30728

Re: Hamilton County Natural Hazards Mitigation Plan

Dear Commissioner Heiskell:

The purpose of this letter is to notify adjacent county governments that Hamilton County, Tennessee is in the process of updating our Natural Hazards Mitigation Plan. The current plan was approved by the Federal Emergency Management Agency in 2005. The plan must be updated every five years. The revised plan will update local demographics, development trends, risk and vulnerability to natural hazards, hazard related events, and the status of past mitigation actions. Several participating local jurisdictions have revised their mitigation actions to reflect local concerns, as well as capability for implementation.

If you have any questions or would like to review and comment on a draft of the updated plan please contact Greg Helms at 423-209-6917.

Sincerely,

Claude Ramsey
County Mayor

HAMILTON COUNTY
OFFICE OF THE COUNTY MAYOR
208 Courthouse
Chattanooga, Tennessee 37402

CLAUDE RAMSEY
County Mayor

September 15, 2010

County Executive Ted Rumley
71 Case Avenue
Trenton, GA 30752

Re: Hamilton County Natural Hazards Mitigation Plan

Dear County Executive Rumley:

The purpose of this letter is to notify adjacent county governments that Hamilton County, Tennessee is in the process of updating our Natural Hazards Mitigation Plan. The current plan was approved by the Federal Emergency Management Agency in 2005. The plan must be updated every five years. The revised plan will update local demographics, development trends, risk and vulnerability to natural hazards, hazard related events, and the status of past mitigation actions. Several participating local jurisdictions have revised their mitigation actions to reflect local concerns, as well as capability for implementation.

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Sincerely,

Claude Ramsey
County Mayor

HAMILTON COUNTY
OFFICE OF THE COUNTY MAYOR
208 Courthouse
Chattanooga, Tennessee 37402

CLAUDE RAMSEY
County Mayor

September 15, 2010

County Manager Mike Helton
800 Lafayette Street
Ringgold, GA 30736

Re: Hamilton County Natural Hazards Mitigation Plan

Dear County Manager Helton:

The purpose of this letter is to notify adjacent county governments that Hamilton County, Tennessee is in the process of updating our Natural Hazards Mitigation Plan. The current plan was approved by the Federal Emergency Management Agency in 2005. The plan must be updated every five years. The revised plan will update local demographics, development trends, risk and vulnerability to natural hazards, hazard related events, and the status of past mitigation actions. Several participating local jurisdictions have revised their mitigation actions to reflect local concerns, as well as capability for implementation.

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Sincerely,

Claude Ramsey
County Mayor

HAMILTON COUNTY
OFFICE OF THE COUNTY MAYOR
208 Courthouse
Chattanooga, Tennessee 37402

CLAUDE RAMSEY
County Mayor

September 15, 2010

County Mayor Gary Davis
P. O. Box 1167
Cleveland, TN 37312

Re: Hamilton County Natural Hazards Mitigation Plan

Dear Mayor Davis:

The purpose of this letter is to notify adjacent county governments that Hamilton County, Tennessee is in the process of updating our Natural Hazards Mitigation Plan. The current plan was approved by the Federal Emergency Management Agency in 2005. The plan must be updated every five years. The revised plan will update local demographics, development trends, risk and vulnerability to natural hazards, hazard related events, and the status of past mitigation actions. Several participating local jurisdictions have revised their mitigation actions to reflect local concerns, as well as capability for implementation.

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Sincerely,

Claude Ramsey
County Mayor

HAMILTON COUNTY
OFFICE OF THE COUNTY MAYOR
208 Courthouse
Chattanooga, Tennessee 37402

CLAUDE RAMSEY
County Mayor

September 15, 2010

County Mayor Garland Lankford
P. O. Box 156
Decatur, TN 37322

Re: Hamilton County Natural Hazards Mitigation Plan

Dear Mayor Lankford:

The purpose of this letter is to notify adjacent county governments that Hamilton County, Tennessee is in the process of updating our Natural Hazards Mitigation Plan. The current plan was approved by the Federal Emergency Management Agency in 2005. The plan must be updated every five years. The revised plan will update local demographics, development trends, risk and vulnerability to natural hazards, hazard related events, and the status of past mitigation actions. Several participating local jurisdictions have revised their mitigation actions to reflect local concerns, as well as capability for implementation.

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Sincerely,

Claude Ramsey
County Mayor

HAMILTON COUNTY
OFFICE OF THE COUNTY MAYOR
208 Courthouse
Chattanooga, Tennessee 37402

CLAUDE RAMSEY
County Mayor

September 15, 2010

County Executive George Thacker
Courthouse Room 103
Dayton, TN 37321

Re: Hamilton County Natural Hazards Mitigation Plan

Dear County Executive Thacker:

The purpose of this letter is to notify adjacent county governments that Hamilton County, Tennessee is in the process of updating our Natural Hazards Mitigation Plan. The current plan was approved by the Federal Emergency Management Agency in 2005. The plan must be updated every five years. The revised plan will update local demographics, development trends, risk and vulnerability to natural hazards, hazard related events, and the status of past mitigation actions. Several participating local jurisdictions have revised their mitigation actions to reflect local concerns, as well as capability for implementation.

If you have any questions or would like to review and comment on a draft of the updated plan please contact Greg Helms at 423-209-6917.

Sincerely,

Claude Ramsey
County Mayor

HAMILTON COUNTY
OFFICE OF THE COUNTY MAYOR
208 Courthouse
Chattanooga, Tennessee 37402

CLAUDE RAMSEY
County Mayor

September 15, 2010

County Mayor Robert Collier
P. O. Box 149
Pikeville, TN 37367

Re: Hamilton County Natural Hazards Mitigation Plan

Dear Mayor Collier:

The purpose of this letter is to notify adjacent county governments that Hamilton County, Tennessee is in the process of updating our Natural Hazards Mitigation Plan. The current plan was approved by the Federal Emergency Management Agency in 2005. The plan must be updated every five years. The revised plan will update local demographics, development trends, risk and vulnerability to natural hazards, hazard related events, and the status of past mitigation actions. Several participating local jurisdictions have revised their mitigation actions to reflect local concerns, as well as capability for implementation.

If you have any questions or would like to review and comment on a draft of the updated plan please contact Greg Helms at 423-209-6917.

Sincerely,

Claude Ramsey
County Mayor

HAMILTON COUNTY
OFFICE OF THE COUNTY MAYOR
208 Courthouse
Chattanooga, Tennessee 37402

CLAUDE RAMSEY
County Mayor

September 15, 2010

County Executive Michael Hudson
P. O. Box 595
Dunlap, TN 37327

Re: Hamilton County Natural Hazards Mitigation Plan

Dear County Executive Hudson:

The purpose of this letter is to notify adjacent county governments that Hamilton County, Tennessee is in the process of updating our Natural Hazards Mitigation Plan. The current plan was approved by the Federal Emergency Management Agency in 2005. The plan must be updated every five years. The revised plan will update local demographics, development trends, risk and vulnerability to natural hazards, hazard related events, and the status of past mitigation actions. Several participating local jurisdictions have revised their mitigation actions to reflect local concerns, as well as capability for implementation.

If you have any questions or would like to review and comment on a draft of the updated plan please contact Greg Helms at 423-209-6917.

Sincerely,

Claude Ramsey
County Mayor

HAMILTON COUNTY
OFFICE OF THE COUNTY MAYOR
208 Courthouse
Chattanooga, Tennessee 37402

CLAUDE RAMSEY
County Mayor

September 15, 2010

County Mayor David Kirk
P. O. Box 789
Jasper, TN 37347

Re: Hamilton County Natural Hazards Mitigation Plan

Dear Mayor Kirk:

The purpose of this letter is to notify adjacent county governments that Hamilton County, Tennessee is in the process of updating our Natural Hazards Mitigation Plan. The current plan was approved by the Federal Emergency Management Agency in 2005. The plan must be updated every five years. The revised plan will update local demographics, development trends, risk and vulnerability to natural hazards, hazard related events, and the status of past mitigation actions. Several participating local jurisdictions have revised their mitigation actions to reflect local concerns, as well as capability for implementation.

If you have any questions or would like to review and comment on a draft of the updated plan please contact Greg Helms at 423-209-6917.

Sincerely,

Claude Ramsey
County Mayor